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Sport Fishery Abstracts

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of papers on limnology, ecology, natural history and other fields of specialization will be included when the subject has application to the conservation of sport fish and the restoration of sport fishing.

One volume consisting of not more than four numbers will be issued each year. Each number contains separate Author and Subject indexes, with the final number of each volume containing cumulative indexes.

The last number of each volume contains a list of publications screened for appropriate material. Suggestions for improving the usefulness and coverage of Sport Fishery Abstracts are solicited.

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ERRATA

Abstract No. 2930 inadvertently omitted.

2931. Dugdale, Richard, Vera Dugdale, John Neess, and John Goering. 1959. NITROGEN FIXATION IN LAKES. Science, Vol. 130, No. 3379, pp. 359-360.

Incorporation of N^{15} into the fixed nitrogen fraction of natural lake waters has been studied for the purpose of estimating rates of primary nitrogen fixation. Experiments in Pymatuning Reservoir, Pennsylvania, in Lake Mendota, Wisconsin, and in two lakes in Alaska indicate that fixation occurs at measurable, sometimes high, rates. (Auth. abst.)

2932. Knipling, E. F. 1959. STERILE-MALE METHOD OF POPULATION CONTROL. Science, Vol. 130, No. 3380, pp. 902-904.

The principle of animal population control through the use of sexually sterile males has been demonstrated for insects. Sexually sterile males that retain their sexual vigor and behavior will exert greater influence in regulating animal populations than can be achieved by destroying or removing the same number of individuals from the population. This hypothesis is supported by calculations showing theoretical population trends in assumed insect and animal populations subjected to treatments that destroy or eliminate certain percentages of the individuals as compared with a procedure that retains or replaces the same number of males in the population after sterilization. The maximum regulating effect that can be achieved is in direct proportion to the ratio of sterile to fertile males competing for mates.

The advantages of inducing sexual sterility in a natural population of an insect species by chemical or other treatment over the method of rearing and releasing a dominating population of sterile males are considered. It is suggested that the sterile-male method may have practical application for undesirable populations of certain wild animals as well as for insects. (Auth. summ.)

2933. Krumholz, Louis A. 1959. STOMACH CONTENTS AND ORGAN WEIGHTS OF SOME BLUEFIN TUNA (THUNNUS THYNNUS, LINNAEUS), NEAR BIMINI, BAHAMAS. Zoologica Scientific Contributions of the New York Zoological Society, Vol. 44, Part 3, Nos. 6 to 8, pp. 127-131.

The stomach contents of seven bluefin tuna taken near Bimini, Bahamas, in May, 1956, consisted of 560 young-of-the-year porcupine fish, 90 salps, the axial skeletons of 5 small, eel-like fish, 4 protunid crabs, the beak of 1 octopus, and a plant leaf. The gonads of all specimens of tuna appeared to be near spawning condition. The weights of viscera indicated that the relative weight of the heart of the bluefin tuna was nearly twice that of the hearts of each of the Atlantic marlins or the sailfish, and even greater than those of each of seven freshwater fishes. (Auth. summ.)

2934. Morrow, James E., Jr. 1959. DISTRIBUTION OF THE BLUE MARLIN AND BLACK MARLIN IN THE INDO-PACIFIC. Bulletin of Marine Science of the Gulf and Caribbean, Vol. 9, No. 3, pp. 321-323.

The distributions of blue marlin (Makaira mazara) and black marlin (Istiompax indicus) (fishes, family Istiophoridae) are described, with detailed records of occurrences. The popular name "Indo-Pacific blue marlin" is suggested for M. mazara. (Auth. abst.)

2935. Price, Joseph B., and Richard R. Priddy. 1959. COLORIMETRIC DETERMINATIONS OF NITRITE AND NITRATE NITROGEN IN BRACKISH COASTAL WATERS. Bulletin of Marine Science of the Gulf and Caribbean, Vol. 9, No. 3, pp. 310-314.

A simple, rapid colorimetric procedure has been developed for determining the nitrite content of brackish coastal waters. A slight modification permits analysis of nitrate content. Both methods eliminate conflict with other ions. Each takes but 15 to 20 minutes. They can be used by persons who are not skilled chemists.

The procedures are presented as an aid to geologists and biologists who have had difficulty in correlating rapidly changing lateral, vertical and hourly chemical content with other brackish water data, especially near shore. The nitrite content of Mississippi's coastal water is 0.03 to 0.05 ppm. Nitrate content is 0.04 to 0.06 ppm.

The procedures are modifications of a 1954 method developed by Nelson, Kurtz and Bray for plant and soil analysis. Old colorimetric procedures are utilized in diazotization of sulfanilic acid by the nitrite ion and subsequent coupling with 1-napthylamine to form a red dye. As in the Nelson-Kurtz-Bray method, reagents are added as powdered mixtures which are stable for at least two months. One mixture is used for nitrite, only. The other is identical except that powdered zinc is added, to reduce nitrates to nitrites. Nitrate content is the difference between the nitrite determination and the determination after the nitrate is reduced to nitrite. (Auth. abst.)

2936. Needham, Paul R., and Albert C. Jones. 1959. FLOW, TEMPERATURE, SOLAR RADIATION, AND ICE IN RELATION TO ACTIVITIES OF FISHES IN SAGEHEN CREEK, CALIFORNIA. Ecology, Vol. 40, No. 3, pp. 465-474.

A study of ecological conditions in winter in relation to activity of fishes in Sagehen Creek, California, showed that there exist, temperaturewise, two long periods of acclimation, one in the fall and one in the spring. These prepare fish for both the low water temperatures of winter and the high temperatures of summer. Water temperatures show less fluctuation in winter than in summer both because of the smaller amount of net solar radiation and the storing of heat as latent heat of fusion during ice formation. Bottom macrofauna is abundant as food for trout in winter and trout were observed to feed on numerous occasions when the water temperature was between 32° and 33° F. It is concluded that 32° F. is within the zone of tolerance of trout and that trout are able to resist water temperatures below 32° F. for short periods of time. Floods may act as a decimating factor to fish populations by

destroying eggs and reducing bottom macrofauna.

Anchor ice was shown to be an important ecological factor since it raises the water level in pools and reduces the flow over riffles. Anchor ice formed only in those areas of the stream which had no upwelling of relatively warm ground water through the substratum. Anchor ice, when it is breaking up, melting or otherwise dispersing, dislodges considerable amounts of the bottom macrofauna, thus making more food available to trout at such times.

Trout exhibited territorial behavior, showed a strong preference to occupy sheltered locations, and in shallow water were more numerous during the night than during the day.

The high winter mortalities of trout populations which have been observed are probably not the result of lack of food or long period of low temperatures. More likely causes are sudden catastrophes such as severe floods or suffocation under collapsed snow banks or dewatering of stream sections by ice dams.

2937. Houston, Arthur Hillier. 1959. OSMOREGULATORY ADAPTATION OF STEELHEAD TROUT (SALMO GAIRDNERI RICHARDSON) TO SEA WATER. Canadian Journal of Zoology, Vol. 37, No. 5, pp. 729-748.

Steelhead trout transferred from fresh water into sea water exhibited two distinct phases in osmoregulatory adaptation. The first, or adjustive phase, was distinguished by marked departures from freshwater levels and distributions of water and electrolytes. Increases in muscle chloride space indicated transfer of fluids from cells into the extracellular compartment. Plasma levels of water, chloride, sodium, and potassium rose, while that of calcium remained relatively constant. The ratio of plasma sodium to chloride fell sharply suggesting a condition of acidosis. Cellular calcium concentrations rose markedly, while smaller increases were seen in chloride and potassium levels. Changes in calcium appeared to be a function of both cellular dehydration and electrolyte uptake. Changes in cellular potassium concentrations were related primarily to dehydration since tissue levels of this ion fell slightly in sea water. The roles of active electrolyte excretory processes, and the passive withdrawal of ions from the circulating fluids by complex formation, have been considered as osmoregulatory mechanisms leading to the establishment of the second, or regulative phase of adaptation to sea water. (Auth. abst.)

2938. Garside, E. T. 1959. SOME EFFECTS OF OXYGEN IN RELATION TO TEMPERATURE ON THE DEVELOPMENT OF LAKE TROUT EMBRYOS. Canadian Journal of Zoology, Vol. 37, No. 5, pp. 689-698.

Lake trout embryos were exposed to dissolved oxygen levels approximating 2.5, 3.5, 4.5, and 10.5 ppm at each of four temperatures, 2.5° C., 5.0° C., 7.5° C., and 10.0° C., from fertilization to a late stage of development. The three low oxygen levels caused retardations in the developmental rates resulting in delayed hatching and lengthening of the hatching period, reduction of vitelline circulatory structures, and abnormalities of head and trunk. The low oxygen levels at 10° C. caused total mortality just prior to hatching. These results are discussed and compared with previous findings. (Auth. abst.)

2939. Rose, S. Meryl. 1959. POPULATION CONTROL IN GUPPIES. The American Midland Naturalist, Vol. 62, No. 2, pp. 474-481

The production of guppies varies inversely with the concentration of adults.

The number of young eaten increases with density of the adult population.

Under crowded conditions more young guppies survive when white clouds are grown with them. Under uncrowded conditions no effect of the white clouds could be observed.

The fact that water changes with conditioned water from other kinds of fish, increases guppy production and partially eliminates the effects of crowding leads to the suggestion that guppies may belong to the growing list of organisms for which it is known that rather specific water-borne products act to limit the population. (Auth. summ.)

2940. Dood, J. M., M. H. I. Dood, and C. K. Goddard. 1959. FORCE-FEEDING FISH UNDER EXPERIMENTAL CONDITIONS. Nature, Vol. 184, No. 4699, pp. 1660-1661.

Two satisfactory methods have been evolved. One utilizes commercially available vaginal applicators which are plastic cylindrical syringes that can be completely emptied. This applicator holds only 6 grams, necessitating several refillings to feed an adult dogfish. The other method, which is more rapid utilizes a modified sausage-making machine which holds 230 grams. The rod of the piston is threaded permitting extrusion of a known quantity of food by counting the number of turns of the piston handle. This method can be carried out by a single operator while the first method requires two. Fifty dogfish, each receiving the same quantity of food, have been fed in one hour by the second method.

2941. Allen, K. Radway. 1959. THE DISTRIBUTION OF STREAM BOTTOM FAUNAS. Proceedings of N. Z. Ecological Society, No. 6, pp. 5-8.

Departures from random distribution are in one of two directions, either too evenly distributed or gathered in clusters. Behavior of the animals or nature of the environment may influence either course. Environment non-uniformity raises the vitally important question of scale of irregularity. The scale must be directly related to size and habits of the animal being studied.

It should be noted that the degree of variation among selected similar samples is much too great to be due purely to random effects and if it is not due to unidentified environmental factors the behavior of the animals must be involved. The variance of a purely random distribution would be about equal to its mean; in the series so far studied the

variance has always been very much greater, often 20 to 40 times the mean.

2942. Chandrasekhar, N. 1959. MULTIPLE HAEMOGLOBINS IN FISH. Nature, Vol. 184, No. 4699, pp. 1652-1653.

Blood of Ophicephalus punctatus Bloch contains 3 haemoglobins; that of Catla catla, Labeo calbasu, Labeo bata, and Tilapia mosambica contains 2; and that of five other species tested, Ophicephalus striatus, Labeo rohito, cirrhina mrigala, Hetero pneustes fossilis (Bloch), and Clarias batrachus (Linn), only one each. All the five species having multiple haemoglobins have a major component, accounting for nearly 70-90 percent of all haemoglobins. All the components of fish haemoglobins have a low mobility similar to those of gamma-globulins of human serum or even lower. Haemoglobin patterns in fish do not seem to conform to any distinct family characteristic.

2943. Sowards, Charles L. 1959. EXPERIMENTS IN HYBRIDIZING SEVERAL SPECIES OF TROUT. Progressive Fish-Culturist, Vol. 21, No. 4, pp. 147-150.

A good hatch (73.0%) was obtained for the F_1 generation of brookinaw trout (brook trout female x lake trout male) in spite of unorthodox handling during the incubation period. There was no significant post-hatching mortality. The fish were sexually mature at the end of 4 years and proved to have good fertility and high fecundity.

Hatching success for two lots of the F_2 generation was 56.4% and 78.7%, respectively. Hatching success of a back-cross with a brook trout male was 94.1%, and that of a back-cross with a brook trout female was 82.2%.

A cross between a brookinaw female and a brown trout male yielded a hatch of 4.8%. A cross between a brown trout female and a brookinaw male produced a hatch of 32.2%. Mortality in the following 23 days reduced this to 0.7%.

Poor results were obtained with the F_1 generation of splake trout. The hatching success of a cross between a lake trout female and a brook trout male was 38.5%. (Auth. abst.)

2944. Schiffman, Robert H. 1959. METHOD FOR REPEATED SAMPLING OF TROUT BLOOD. Progressive Fish-Culturist, Vol. 21, No. 2, pp. 151-153.

To draw blood samples from--or make injections into--intact fish, the hypodermic needle is inserted into the dorsal aorta. The puncture site is just posterior to the fourth gill arch in the center of the roof of the mouth, where the eight veins from the gills join to form the dorsal aorta. In one test in which 15%, 20%, and 25% of the blood volume were drawn from rainbow trout, all fish showed temporary hemorrhagic shock. In another test, eight 1-ml samples of blood were taken from a 1,200-g trout over a period of 13 days. The withdrawal of 2 ml of blood on the 14th day caused severe anoxia. Examination of the blood demonstrated acute anemia. All fish in the tests survived, showing no apparent damage. (Auth. abst.)

2945. Johnson, Malcolm C. 1959. FOOD-FISH FARMING IN THE MISSISSIPPI. Progressive Fish-Culturist, Vol. 21, No. 4, pp. 154-160.

The problems of the producer of fresh-water fish for food have been largely neglected by professional fishery workers. In recent years, nevertheless, there has been developed in the lower Mississippi Valley, principally by agriculturists, a kind of fish "farming" which, with more information and improved methods and techniques, promises to become profitable and increasingly important. Methods now used in Arkansas ricelands for fish production, and such features as water supply, impoundments, levee construction, fertilization, stocking rates, wild-fish control, and harvest periods, are discussed. Costs of building levees, pumping water, and fertilization are estimated. Returns which may be anticipated by the fish farmer under present conditions are not high but are roughly equal to returns from other crops alternated with rice. Income from sale of fish is often supplemented by sale of permits for sport fishing and waterfowl hunting. (Auth. abst.)

2946. Phillips, Arthur M., Jr., and Richard F. Dumas. 1959. THE CHEMISTRY OF DEVELOPING BROWN TROUT EYED EGGS AND SAC FRY. Progressive Fish-Culturist, Vol. 21, No. 4, pp. 161-164.

Chemical analyses of eyed eggs and sac fry of brown trout (Salmo trutta) showed a continual change in chemistry throughout the period of development. The present experiments confirmed the earlier work of this laboratory on the development prior to hatching. During the sac-fry stage, the water content increased and the protein content decreased. The decrease in fat may be correlated with changes in water content, but no such correlation was established for the decrease in protein. There was no difference in the chemistry of small trout eggs (from 2-year-old fish) and large eggs (from 3-year-old fish). (Auth. abst.)

2947. Combs, Bobby D., and Roger E. Burrows. 1959. EFFECTS OF INJECTED GONADOTROPHINS ON MATURATION AND SPAWNING OF BLUEBACK SALMON. Progressive Fish-Culturist, Vol. 21, No. 4, pp. 165-168.

Spawning was advanced as much as 1 month in adult blueback salmon (Oncorhynchus nerka) injected with whole macerated chum salmon (O. keta) pituitary glands, but prohibitive losses were incurred in all early spawned eggs. Injections of carp pituitaries, mammalian gonadotrophin, and estradiol produced no accelerating effect on maturation. The mechanics alone of pituitary injection as a means of accelerating sexual maturation of salmon preclude its use in production operations. (Auth. abst.)

2948. Henderson, Nancy E., and John E. Dewar. 1959. SHORT-TERM STORAGE OF BROOK TROUT MILT. Progressive Fish-Culturist, Vol. 21, No.

4, pp. 169-171.

Milt was collected from male brook trout (Salvelinus fontinalis) and stored at 1.5° C. Samples of milt were added to test lots of eggs from one female at 1, 3, 5, and 7 days of storage. Data are presented on the percentages of eggs eyed and fry hatched in each test group. (Auth. abst.)

2949. Mazuranich, John J., and Walter E. Nielson. 1959. WHITE-SPOT DISEASE OF SALMON FRY. Progressive Fish-Culturist, Vol. 21, No. 4, pp. 172-176.

A study was made to determine causes of white-spot disease among salmon fry. The condition was not produced by subjecting advanced eyed eggs of chinook salmon (Oncorhynchus tshawytscha) to temperature extremes of 33° and 68° F. nor to oxygen deficiency, nor by subjecting eggs of silver salmon (O. kisutch) to routine malachite green treatments (1:200,000 for 1 hour). The condition was produced in silver salmon fry when they were treated with malachite green. (R.R.R.)

2950. Clark, Clarence F. 1959. EXPERIMENTS IN THE TRANSPORTATION OF LIVE FISH IN POLYETHYLENE BAGS. Progressive Fish-Culturist, Vol. 21, No. 4, pp. 177-182.

Cellulite minnow buckets, styrofoam boxes with and without polyethylene liners, and cardboard boxes with polyethylene liners were used experimentally to transport walleye pike fry, muskellunge, bass, and northern pike fingerlings, and Gambusia adults. A cardboard box lined with a transparent polyethylene bag proved to be a satisfactory and economical container for fish transportation. Up to 50,000 fry per package were transported for 9 hours with a survival of 94% or better. Over 34,100,500 walleye were successfully transported by this method in 1957. As many as 1,000 muskellunge (1 to 1.5 inch) and from 35 to 37 7-inch muskellunge per gallon of water were transported. Largemouth bass packaged at the rate of 28 to 153 per gallon had less than 1% loss. About 1,000 northern pike (0.75 inch long) per gallon of water were packaged and shipped 12 hours by air with about 98% survival. Thirty Gambusia breeders per gallon of water were shipped 14 hours by air with the loss of 1 fish. (C.F.C.)

2951. Martin, N. V., and D. C. Scott. 1959. USE OF TRICAINE METHANESULFONATE (M.S. 222) IN THE TRANSPORT OF LIVE FISH WITHOUT WATER. Progressive Fish Culturist, Vol. 21, No. 4, pp. 183-184.

Live adult hybrids of lake trout (Salvelinus namaycush) and brook trout (S. fontinalis) were transferred by anesthetizing them with M.S. 222 and packing them in crushed ice without water. Fish were treated in 5° C. water, with a dosage of 0.25 g of M.S. 222 per gallon of water, and a time under anesthetic of about 8 minutes. All but 5 of 49 fish averaging about 2 lb. survived a 285-mile plane trip and a period of 4 to 4.5 hours in storage. (Auth. abst.)

2952. Boyar, H. C., and C. J. Sindermann. 1959. ADDITIONAL NOTES ON THE MAINTENANCE OF IMMATURE SEA HERRING IN CAPTIVITY. Progressive Fish Culturist, Vol. 21, No. 4, pp. 185-187.

Results of studies to determine the suitability of live cars for the maintenance of herring indicated advantages over the indoor-tank method. A comparison of mean weights of live-car herring and laboratory-tank herring of comparable lengths showed that after 100 days of observation live-car herring were 0.5 to 1.5 g. heavier than the laboratory-tank herring, the greater differences occurring for fish 76 to 81 mm. in length. Usually the difference in weight was equivalent to 1/3 the body weight of the fish. Laboratory-tank herring were fed artificially; live-car herring depended on natural food only. (Auth. abst.)

2953. McCarraher, D. B. 1959. THE NORTHERN PIKE-BLUEGILL COMBINATION IN NORTH-CENTRAL NEBRASKA FARM PONDS. Progressive Fish-Culturist, Vol. 21, No. 4, pp. 188-189.

The northern pike-bluegill combination in north-central Nebraska farm ponds appears to have promise. Two new farm ponds of 5.5 and 7.1 surface acres, respectively, were stocked with pike fingerlings and adult bluegills at different ratios (5:1 and 36:1). Natural pike reproduction has occurred in both ponds. Bluegills are the predominant forage for all year classes of pike. Growth increment of the pike has been good but below that recorded for Nebraska's sandhill lakes. Pike fishermen may expect to harvest approximately 44% of the stocked fingerlings. To date, natural recruitment has precluded the need for additional pike stocking. (Auth. abst.)

2954. Joeris, Leonard L. 1959. RAPID MEASUREMENT OF FISH. Progressive Fish-Culturist, Vol. 21, No. 4, pp. 190-191.

A measuring board made of soft wood has a thin strip of plastic attached. Measurements of fish placed on this board are recorded by punching holes in the plastic strip. For tabulation of the data, the plastic strip is taped to a transparent ruler and placed on the lighted screen of a scale projector or on an illuminated tracing table. Using this procedure, one man can measure and record a large number of fish considerably faster than the usual two-man crew. (Auth. abst.)

2955. Belousov, A. A. 1958. DETERMINING THE SURFACE AREA OF THE BODY OF A FISH. (OPREDELENIYE PLOSHEHADI TELA RYBY.) Rybnoye khozyaystvo, Vol. 34, No. 1, Moscow, Jan. 1958, pp. 53-57.

Five different formulas for calculating a surface area of the body of a fish were derived. Three of these formulas are based on the total weight and two on linear dimensions of a fish. It is concluded that the formulas based on linear dimensions of a fish are more accurate. The two formulas based on linear dimensions are as follows:

(1) $P=k_4 l^2$; and (2) $P=k_5 l. C$; where P= total surface area in cm^2; l=length in cm.; C=maximum circumference in cm. (where C=2H+d, H=maximum height, and d=maximum thickness); and k_4 and k_5 = coefficients; for bream, k_4 was 0.61 and k_5 was 0.70; for carp, k_4 was 0.57 and k_5 was 0.73; for pike-perch, k_4 was 0.42 and k_5 was 0.74. (A.S.)

2956. Genina, N. V., E. F. Martinson, and V. Ya. Redikson. 1958. ON BIOLOGICAL METHODS OF ARTIFICIAL BREEDING OF THE PIKE. (O BIOTEKHNIKE ISKUSSTVENNOGO RAZVEDANIYA SHCHUKI.) Rybnoye Khozyaystvo, Vol. 34, No. 2, Moscow, Feb. 1958, pp. 26-28.

Detailed description of a method of artificial breeding of the pike is presented. The roe was stripped into enameled basins not more than 1 liter in each. Sperm was added and carefully mixed with roe; after 2-3 min., a little water was added. The thickness of a roe layer was kept at 3 cm and the height of the water above it about 10-20 cm. The incubation lasted about 8 days at water temperature of 12-13°C. (A.S.)

2957. Beliaev, E. V. 1958. EXPERIMENTS ON RAISING DAPHNIA MAGNA DURING THE WINTER, (OPYT VYRASHCHIVANIIA DAFNII MAGNA V ZIMNII PERIOD.) M., Rybnaia Promyshlennost', No. 34, pp. 52-55.

The technical side of the experiment was based on the search of the largest doses of spleen of animals and fish to be introduced into 1 m^3 of water. The aim was to cultivate daphnia in cold atmosphere on remains of animal origin, such as frogs, house and field mice, fish, and bird corpses.

The dead animals were placed in 100 grams to 1 m^3 of water, put through a meat grinder, and placed in a daphnia basin which had low water temperatures. Grinding the mixture quickened the process of disintegration of fibers, so that the seaweed and microorganisms necessary for feeding daphnia developed within a short time.

Under low temperature conditions, daphnia was cultivated in open concrete basins, the regime depending entirely on the meteorologic conditions in the zone of economy. In the Chernorechensk trout fishery, during the months of Dec.-Feb., the temperature of the water in the basin fluctuated between 4-11.8°. There was a three-day period when the daphnia ponds were ice-covered, but daphnia were not harmed. Experiments showed that when daphnia basins were covered with hothouse frames, a strong oxidation occurred; in this oxidation condition pH fluctuated within 4-6.5° range. This atmosphere was conducive to daphnia growth.

Winter cultivated daphnia insures live food for the young of rainbow trout when the latter begin to eat. Using animal corpses for daphnia culture is recommended only when there is complete decomposition of the previously introduced portion which, in turn, depends on the oxygen content of the water and on its temperature.

Tests have shown that, depending on the broad range temperatures in which Daphnia magna can survive, it is possible to create conditions where we can obtain in winter 20-30 grams of daphnia from 1 m^3 of water.

In Abkhaz Daphnia magna is successfully cultivated in concrete basins on decomposed organic waste of animal origin, a small quantity of bacteria, and green seaweed.

Daphnia can survive during the winter if it has plenty of food. The water temperature should not be below 4°; the basin should not freeze, and where necessary the water should be heated. (R.G.K.)

2958. Batenko, A. I. 1958. DETERMINATION OF PHOSPHORIC ACID IN THE WATER AND IN THE SOIL OF PONDS. (OPREDELENIE FOSFORNOI KISLOTY V VODE I POCHVE PRUDOV.) M. Rybnaia Promyshlennost', No. 34, pp. 37-44.

The application of mineral fertilizer in ponds, with the purpose of increasing natural productivity, is at present widespread. The mineral fertilizer most in use is super-phosphate. It contains phosphoric acid which is readily soluble in water and easily assimilated by bacterial flora and by pond plankton. The urgent need for super-phosphate in pond fisheries is due to the fact that phosphorus is found only in minute quantities in almost all soils of the USSR territory.

A higher phosphoric acid content, which equals 21 mg of P205 in 100 grams is found only in soils of nursery ponds of the "Leninskii" fishery. This is due to the fact that the Leninskii" fisheries receive sewer discharges rich in phosphorus. Also, a high content of water-soluble phosphoric acid is found in village areas and only in those densely populated. Then again, water of the rivers supplying these ponds is poor in phosphoric acid.

Even if sewage brings a certain amount of phosphorus into the ponds, its action is only of short duration, for the phosphoric acid is used up by the pond flora and is absorbed by the soil.

Fertilizing ponds with super-phosphate does not always guarantee good results, for the reaction of phosphoric acid depends upon other forms of food in the ponds, also on the interaction of the acid with the pond soils, etc. And the larger the dose of super-phosphate introduced, the greater is the amount of P205 absorbed by the soil. (R.G.K.)

2959. Fedin, S. P. 1958. THE IMPORTANCE OF PIKE IN THE STRUGGLE WITH INFERIOR AND MUD FISH. (ZNACHENIE SHCHUKI V BOR'BE S MALOTSENNOI I SORNOI RYBOI.) M., Rybnoe Khoziaistvo, No. 3, March, pp. 25-27.

Pike is widely distributed in rivers, small gulfs, and bays in the Dniepr Basin. It is found in deep lakes with clean, cold water but also in lakes with a slimy mud bottom. Its abundance is determined by its ability to survive in water basins, even where there is little food to its liking.

Pike reaches sexual maturity at one year of age. Early maturity of the sex products in pike is brought on, in the southern section, by favorable

ecological conditions and long periods of plant growth, as compared with the northern part of the USSR. The roe of old pike is larger than the roe of young pike, so that one gram of roe of the young fish has more eggs than one gram of roe of older pike.

In southern Ukraine, due to hydroelectric conditions, pike spawning lasts almost two months (Feb. 20-April 20). In 1956, pike had late spawning. A pike, caught in the Dniepr River April 6, at +1.6° and in the tributaries at +4.2°, still had roe and was at IV-V stage of maturity. Large pike lay eggs under ice. In spring pike spawn in bays at a depth of 0.3-1.2 m., when the water is 0.65-10° and higher, and they do not cease feeding during the spawning period.

Attributable to early spawning, young pike, as compared with young fish of other forms, has a prolonged growing period which is advantageous in the struggle for existence. Growing fast, young pike reach, in June, 115-132 mm and weigh 9.7-18.4 grams. In August they reach 160-180 mm and weigh 40-50 grams. Yearlings reach 277-354 mm and weigh 127-305 grams.

Examination of pike stomachs disclosed that they feed on bream, gudgeon, perch, Abramis ballerus, Blicca bjoerkna, roach, ruff, Leuciscus idus, etc. In their search for food, ravenous pike consume the inferior, low-valued, and various forms of mud fish.

For example, in the Dniepr basin and in Samara fisheries the mud fish population grows rapidly as soon as pike catches increase. Such a condition prevails if large hauls of pike are in practice. There is no danger that pike may become predominant, for the regime of basins of this type naturally limit excessive pike production. Besides, in spring, pike can be caught with nets or other fishing equipment whenever it is desirable to limit their number.

To check rapid increase of mud fish, pike catches should be regulated. (R.G.K.)

2960. Kuznetsov, A. P. 1958. FEEDING GROUNDS OF FLOUNDER IN THE KRONOTSK GULF. (POLIA PITANIIA KAMBALL (PLEURONECTIDAE) V KRONOTSKOM ZALIVE.) M., Rybnoe Khoziaistvo, No. 1, Jan., pp. 7-11.

Due to temperature regime of the water, in the spring-summer period, flounder are compelled to feed in the less nutritive shallow water areas; only in exceptional warm years do flounder have the opportunity to feed in both the shallow water and the richer deep waters. The main flounder concentrations during the spring-summer period are in the regions near the mouths of rivers and other shallow areas where amphipods are abundant.

In the winter period, December-March, flounder concentrate at depths of 200-300 meters, the region of greatest edible biomass benthos. However, during this period, the flounder are practically immobile and cease feeding. Thus this section of the Gulf, rich in food, is used very little by flounder as a feeding ground.

2961. Petrenko, I. N. 1957. RAISING THE FIRST YEAR'S PRODUCT OF KURINSK SALMON ON VARIOUS FOODS. (VYRASHCHIVANIE SEGOLETKOV KURINSKOGO LOSOSIA NA RAZLICHNYKH KORMAKH.) M., Rybnaia Promyshlennost', No. 30, pp. 3-14.

The present experiments were carried out during 1952-1955. In 1952-1953 observations were conducted on the young from the first days until their active feeding. In 1952, the tests lasted over six months; in 1953 the tests were continued for 2 1/2 months; in 1954 the work was on fry 60 days old, from the day of active feeding, and lasted 1 1/2 months.

The experimental material through these years was uniform. The young were raised under the same hydrochemical and temperature regime, and in one and the same standard setting, only the feeding varied.

The following conclusions are based on these experiments:

1. In raising the year's crop of Kurinsk salmon, satisfactory results have been obtained with fish fed on artificial food plus a small amount of living food (enchitreid, zooplankton, chironomeid). This crop showed normal growth and good resistance to disease. The natural food included in this diet, easily assimilated by the young, provides the necessary albumen and vitamins for their development.

2. Artificial foods with the addition of only enchitreid do not give the desired results as to size and physiological development.

3. The year's crop of the kurinsk salmon raised on enchitreid and zooplankton, proved resistant to disease and had better weight and linear growth than the group raised on enchitreid and artificial food.

4. Further experiments confirmed that rations are of primary importance for the young salmon. These rations should include living food which insure good growth and development, even when these foods are often incomplete in regard to the general requirements of the ash content.

The foods are insufficient in mineral salts; the young salmon meet this lack by deriving the salts from the water. (R.G.K.)

2962. Smirnov, A. I. 1958. MORE ATTENTION SHOULD BE GIVEN TO THE REPRODUCTION OF O. TSCHAWYTSCHA. (BOL'SHE VNIMANIIA VOSPROIZVODSTVU ZAPASOV CHAVCHI, O. TSCHAWYTSCHA.) M. Rybnoe Khoziaistvo, No. 3, March, pp. 8-12.

O. tschawytscha is one of the important and highly-valued Far-Eastern salmon, but little attention is paid to its production and the supply is small. The stock can be increased by artificial breeding.

In 1956, with the cooperation of Prof. of Biology F. V. Krogius, Prof. of Geography E. M. Krokhin and with the aid of the local citizens, the author organized an expedition in Kamchatka, with the aim to observe O. tschawytscha spawning on-the-spot and to trace morphological development.

O. tschawytscha spawning grounds are located in the Aleshka Channel in the upper part of the Paratunka River, a tributary of Arachinsk Bay. Current breeders were obtained, the roe artificially fertilized and submitted to the Observation Center on Lake Dal'ne where its development was observed.

Water temperatures, bottom characteristics, currents, condition of roe, and competition with similar fishes were observed. Fecundity and size, color, and membrane thickness of the roe were compared with those of other salmon.

Comparing data on the development of all six forms of Pacific salmon and their incubation periods, the author states the following:

The incubation period is shorter with those salmon which develop under unfavorable conditions of breathing. Under such conditions, earlier hatching offers the possibility of transplanting the embryo to places of better water circulation.

Unfortunately, there is little information on the ecological condition of spawning grounds in Kamchatka. But it can be stated that O. tschawytscha roe, in its needs, is similar, not to the roe of humpback salmon, but to fall keta roe and to other Pacific salmon which spawn at the outlet of ground water and a deficient oxygen supply.

O. tschawytscha should have a ground of spring water supply containing 30-70% oxygen saturation. In summer, the water temperature should be 5-8° at the beginning of development. The temperature should not be below 4°.

Its roe is stable in mechanical disturbance, such as transportation over rough roads.

Morphologically, the O. tschawytscha embryo hatches at early stages of development. A huge supply of plasma aids in producing a large embryo, 22-23 mm long when out of the membrane. Due to the strong current, O. tschawytscha young can be seen during transition in mid-river current and around shore. They go deep and are exceptionally active.

O. tschawytscha lives in fresh water at least one year. It does not require prolonged fattening - a very important quality.

The loss of O. tschawytscha roe during incubation is lower than that of kisutch and nerka.

Finally, acclimatization tests of Pacific salmon have proven that the production of O. tschawytscha can be increased not only in Kamchatka, but also in rivers of the more southern area down to the Amur basin and northern Hokkaido. It is therefore a fine subject for fish culture. (from abstract by R. G. K.)

2963. Sukhoverkhov, F. M. 1958. MECHANIZED PREPARATION AND DISTRIBUTION OF FOOD TO FISH (MEKHANIZATSIIA PRIGOTOVLENIIA I RAZDACHI KORMOV RYBE.) M., Rybnaia Promyshlennost', No. 34, pp. 27-33.

Preparing food for fish poses the problems of minimizing the loss in distributing the food and in the fish consuming it, and of giving fish food in readily-assimilated form, so as to conserve energy on the part of the fish in digesting the food. Conserving energy in food assimilation conserves also food for each unit of growth of the fish.

For the food to be easily assimilated it must be diluted and moist. Pond fish do not drink water; they utilize it together with the food. Planktonic and benthic food of pond fish contains 80-87% moisture.

A food mixture of cottonseed cake and flour should have 100-120% water added to it. A smaller amount of water will not combine the food. The dough of food mixtures contains 50-54% moisture. More moisture is required when cottonseed cake or parts of it are ground to meal consistency, or when its particles are not larger than 1 mm. Crushing food to meal aids in better assimilation of the food nitrogen and in larger deposits of it in the body of the fish, especially in earlier stages of development.

Flour from cottonseed and its parts should be combined with flour from rye, wheat, flax, these to be combined also with flour from corn, legumes, seeds of dirt grass accumulated on the threshing floor in granaries.

To increase the amount of fish food, it is also necessary to fertilize ponds, especially when the organic matter loses its potency making the introduction of small doses of mineral fertilization essential.

The mechanization of all work in preparing and distributing food is carried out on a special floating boat from which the food is distributed. The entire volume of food, six tons of dry mass, is placed in a bunker which can serve 100 feeding grounds, 60 m distance one from the other and distribute the food within one hour. (R. G. K.)

2964. Vavilova, A. E. 1957. KEEPING O. MASU BREEDERS IN NATURAL NURSE-PONDS. (VYDERZHIVANIE PROIZVODITERLEI SIMY (ONCORHYNCHUS MASU) V ESTESTVENNYKH SADKAKH.) M., Rybnaia Promyshlennost', No. 30, pp. 14-20.

O. masu is caught along the entire shore of the Sakhalin Island, but mostly in the southwestern part of it, in the rivers which have 50% of all spawning salmon. In the waters of Sakhalin there are fewer O. masu than O. keta or humpback-salmon. But because of the delicate, rich meat of O. masu, it is considered more valuable and ranks fourth after O. tschawytscha, O. nerka, and O. kisutch.

O. masu enter the Sakhalin rivers from May-June in stage II of their sexual maturity, and mature at the beginning of August, at the riverheads of small streams of spring water (10-12°). It was essential to keep O. masu breeders until fully mature near fishery stations located at the estuary of a river. All attempts to keep O. masu breeders in artificial nurse-ponds used in Sakhalin fisheries for keta and humpback salmon proved unsuccessful.

In 1954, fisheries on the Taranai River succeeded in keeping O. masu to full sexual maturity by keeping the breeders in tail-water, located 40 km from the mouth of the river for 123 days. Five to six thousand of O. masu breeders were produced here. However, the roe from breeders kept in such condition was of

inferior quality; 70% had partial regeneration. It was impossible to follow up the maturing stages of individual fish since they were gradually caught.

Experiments to keep O. masu breeders in river fisheries, conducted in 1955, also proved unsuccessful. When the temperature rose to 29° all the fish perished. It was then concluded that the maximum temperature O. masu could tolerate was 26-28°, also that it was impossible to keep this species in a natural-channel nurse-pond fed by a river.

In 1956, two nurse-ponds were artificially constructed for O. masu breeders. Nurse-pond No. 1, with an area of 2.3 m^2 and 0.25 m depth, and concrete bottom was located in the waterfall system of the fishery station, and fed by a spring. Nurse-pond No. 2, with a 12 m^2 area, was also fed by a spring (11°), with only its fourth side as the river shore. The speed of the current-inflow was 0.2 m/sec., that of the outflow 0.1 m/sec.

The fish were caught by net and transferred in canvas water barrows (1.0 x 0.7 m) to the nurse-pond 120-150 m from place of haul. Only 15-20 breeders could be placed in each pond; 23 proved uncomfortable. The current was slow and there was no noise, so the fish were calm and did not attempt to jump out.

The breeders were introduced into the pond July 7th. The maturing period was from August 9 through August 22 and during this period only one male died. The pond produced 13 breeders. In spite of low water temperature in pond No. 1 and low oxygen saturation, the sex products developed normally, and all females produced full-value roe. This roe, fertilized with the milt of males from the same pond, incubated normally (98.7%). The loss for this period was insignificant. The standard for pond No. 2 was 10 individuals/m^2. Marking O. masu with elastic bands proved fatal: the elastic cut into muscles, then vertebrae, the tail fell off, and the fish died.

The fish in pond No. 2 were calm but tried to jump out. Their restlessness was due to the falling water into the pond from spring and river. Because of this, some fish were damaged and the loss was 6%.

The rest of the fish were kept in the tail-water. During their stay, some fish near the screen rolled down but did not go far. The temperature of the water in the stream was 11.5°.

O. masu react to water crystallinity which diminishes during rainy weather, and the raising and lowering water levels. During such time O. masu try to swim upstream. Even when the water was made artificially cloudy and the turbidity reached the nurse-pond, the fish became restless and tried to escape.

Such behavior in the fish serves as adjustment, for in nature the diminished water crystallinity coincides with a higher water level and it is then easier for the fish to overcome shoals and rapids when on the way to spawning.

Encouraged by the good results, we began to experiment with the fish on a larger scale but in smaller ponds. The density of this setting was 7 individuals /m^2. The loss for this period (July 29-Sept. 1) was 3.1%. The breeders for this part of the experiment were transferred to the nursery in wagons drawn by horses. Canvas-covered wagon filled with water accommodated 100 adults, and they were transported during the night when temperatures were low.

So, keeping O. masu during 1954 at tail-waters, 40 km from the Taranai River estuary, we observed the natural spawning of the fish. Nurse-ponds have been found suitable for keeping O. masu breeders, which produce a collection of roe directly at the plant. This eliminates prolonged transportation along bad roads, at high temperatures when fish losses are high.

O. masu breeders can be kept in tail-waters up to III and III-IV stages of maturity. After this, the fish can be transferred to nursery ponds until fully mature, or to nurseries of the plant. These ponds are fed by spring water and may be mixed with river water. In case the temperature in the tail-waters rises above 22°, breeders should be transferred, disregarding the stage of maturity. When kept in a pond (or plant nursery) for 30 days or longer the density should be 10 individuals/m^2. The water in the pond should be clear; speed of current is not to exceed 0.1-0.3 m/second. (R. G. K.)

2965. Zlokazov, V. N. 1959. ON THE NEW METHOD OF MARKING STURGEON. (O NOVOM SPOSOBE MECHENIIA OSETROVYKH.) M., Rybnoe Khoziaistvo, No. 3, March, 1. 16.

In 1958, a careful study was made of the process of marking sturgeon and sterlet of the Ob River. Markings used in Soviet Russia and abroad have been found unsatisfactory: easily lost, poorly seen, damage the fish.

The new mark consists of two sturdy, plastic rectangular plates, connected by a crosspiece. The name of the organization responsible for the marking is recorded on one plate and the cipher of the mark on the other plate. The mark is fastened on the dorsal fin by inserting one of the plates, curved lengthwise, through the fin between the 5th and 6th rays, then straightening it and pressing it against the fin. (R. G. K.)

2966. Labas, IU. A. 1959. ON THE IMPORTANCE OF EXTERNAL SIGNS OF FOOD IN FEEDING SALMON AND TROUT YOUNG. (OZNACHENII VNESHNIKH PRIZNAKOV PISHCHI PRI KORMLENII MOLODI LOSOSIA I FORELI.) M., Rybnoe Khoziaistvo, No. 6, June, pp. 32-37.

Salmon and trout react vigorously to artificial food, and they reluctantly change from one kind of food to another. The intensity of their feeding depends not only on the taste and smell of the food, but also on its appearance. The young of brook trout resent immobile food, so their food must be stirred up in the water. Rainbow trout reared on meat rations, readily consume meat balls painted red, or a color close to red.

Experiments were carried out on 2-6-months old Baltic salmon (Salmo salar L.) and on 5-months

old rainbow trout (Salmo irideus Gibbons), reared on spleen, kormalin and oligochaeta. Experimental results showed that fish react to external characteristics of food, such as: mobility, size, form, and color. In all cases the fish preferred mobile objects and organisms crawling along the bottom rather than those swimming in water. Salmon of the year choose objects of definite size (0.07-0.09 length of their own body) and reject non-edible and dead food. Salmon reared on artificial food prefer "compact" form; circular more than cylindrical and broad cylinders rather than narrow ones. Fish reared on food of various colors prefer colorful food. Fish also concentrate in sections of a basin illuminated by a red light, and such illumination is instrumental in intensifying salmon feeding.

Fish also react to contrasting colors between food and background. Dark food is taken from a darker background. But very hungry fish are less discriminating and take food from a contrasting background.

Fish are also more comfortable in familiar surroundings. So fish can be induced to consume more artificial food if they are accustomed to their surroundings.

Food in granulated form is more readily consumed than the one prepared in a uniform mass.

Fish food should be served on suspended pebbles or feeding tables, set in a certain section of the basin. The color of the food should not differ widely from the color of the background. (R. G. K.)

2967. Nikiforov, N. D. 1959. TO FORBID SPINNING CATCHES OF THE SPAWNING SALMON RIVERS. (ZAPRETIT' SPINNINGOVYI LOV NA NERESTOVYKH SEMUZH'IKH REKAKH.) M., Rybnoe Khoziaistvo, No. 8, August, p. 89.

In 1949, the Ministry of the Fishing Industry of USSR apportioned a section along the salmon rivers for sport fishing for salmon.

By 1955, such fishing sections along the Kola and Tiuve Rivers extended to 40 km, accommodating about 500 sportsmen. In 1958, sport fishing extended along 6 rivers to an area of 175 km, plus 2 entire rivers including the spawning grounds. In all, 2,000 people have engaged in this sport and have caught salmon breeders in large quantities. Salmon reproduction has been drastically reduced.

The mass sport fishing on the Kola River was largely responsible for the failure of the Taibol Fishery to meet the required quota of salmon breeders in 1955.

Therefore, the permission to carry on sport fishing on the salmon rivers should be revoked. Spring catches should also be forbidden on the spawning salmon rivers.

There are many unused lakes in the Murmansk region, where Coregonus, trout, perch, pike, and other fish are plentiful. Permits should be granted sport fishermen to fish in these waters throughout the year (R. G. K.)

2968. Kostomarova, A. A. 1959. BIOLOGICAL VALUE OF THE STAGE OF MIXED FEEDING FOR THE DEVELOPMENT OF PIKE LARVAE. (BIOLOGICHESKOE ZNACHENIE ETAPA SMESHANNOGO PITANIIA DLIA RAZVITIIA LICHINOK SHCHUKI.) M., Rybnoe Khoziaistvo, No. 8, August, pp. 25-27.

The biotechnique of artificial cultivation of pike has gained impetus in Russia and abroad. Of importance here is the period during which larvae are kept in the incubator and the time when they are discharged into the river for subsequent foraging.

Pike larvae pass to active feeding even before completing resorption of the yolk sack; that is, in their development they go through the stage of mixed feeding. During this stage, the yolk is gradually used up and the larvae pass to feeding on outside food only. The lack of proper food at the beginning of active feeding retards growth and development. Pike larvae starve if developed only on the endogenous supply of the yolk up to its resorption, and they do not reach 13 mm. Food at this stage is no longer assimilated.

Pike larvae pass to independent feeding on the 9-10th day after hatching, when 12.5-13 mm long, and they begin an active mode of life when 11.5 mm, or two days before they begin active feeding. Pike larvae fed mixed food (yolk and plankton) show definite morphological changes during this feeding stage.

Pike spawn earlier than other fish and have a correspondingly higher rate of growth, so they must have good feeding conditions throughout their entire development.

In artificial cultivation, pike larvae should be provided with small mobile food from the moment when they pass to active feeding. Additional food should be provided for pike larvae two days after they begin to move, when they reach 12.5-13 mm, and before resorption of the yolk sack is completed. (R. G. K.)

2969. Pavlov, I. S. 1959. HYBRIDIZATION TESTS OF PACIFIC SALMON. (OPYTY GIBRIDIZATSII TIKHOOKEANSKIKH LOSOSEI.) M., Rybnoe Khoziaistvo, No. 6, June, pp. 23-24

Hybridization has been carried out with the purpose of obtaining a fast-growing, resistant-to-disease form. In 1953, the roe of O. gorbuscha was fertilized with O. keta milt. This roe was incubated, and the larvae in the nursery grew normally with few losses. The young which evolved from keta roe fertilized with O. gorbuscha milt either perished or were transformed into helpless freaks.

The young hybrids, discharged in March-April, together with young keta, have totalled 300 thousand annually.

In 1956, adult hybrids entered the river together with keta. About 25 thousand hybrids entered the river during the period of keta spawning in 1958.

Externally, the hybrids resemble keta: they have the same physical spawning-characteristics and their sex products also in IV-V, V stages of maturity. The number of eggs, and their size and color resemble those of keta; they are capable of propagation. On their caudal fin, they have distinct

spots like O. gorbuscha. The minimum hybrid length is 66 cm., the maximum - 75 cm. Hybrids mature and migrate into rivers at 2 years of age - a valuable characteristic.

During 1958, hybridization experiments were conducted on a still larger scale. Four hundred thousand gorbuscha eggs fertilized with keta milt were placed for incubation. Also, the roe and milt of hybrids. (R. G. K.)

2970. Zotin, A. I., and A. V. Popov. 1959. SPEEDING THE PROCESS OF PREPARING SALMON ROE FOR INCUBATION BY MEANS OF SALTS OF BIVALENT METALS. (USKORENIE PROTSESSA PODGOTOVKI IKRY LOSOSEVYKH K INKUBATSII PRI POMOSHCHI SOLEI DVUKHVALENTNYKH METALLOV.) M., Rybnoe Khoziaistvo, No. 8, August, pp. 9-15.

In preparing salmon roe for incubation, the fertilized roe is kept in troughs for "swelling" 7-8 hours before it is placed for incubation. This prolongs the working day. With some salmon forms, swelling occurs 60-120 min. after fertilization. Suggestions have been offered to shorten the 7-8 hour period to 3 hours.

The method of shortening this period is based on speeding the process of hardening the membrane. $CaCl_2$, $MgCl_2$ and $SrCl_2$ have been found most suitable for this purpose. The eggs should be placed in a $CaCl_2$ solution of 0.1 N concentration 3-4 hours after fertilization and kept for 1 min. or longer.

It is possible that $CaCl_2$, used to strengthen the egg membrane a few minutes after fertilization, may also be instrumental in curing the peculiar disease of salmon embryos. This disease manifests inself by membrane weakening and premature hatching and is widely spread in Kamchatka and Sakhalin. (R. G. K.)

2971. Diuzhikov, A. T. 1959. ON PIKE CONCENTRATION IN THE TAIL-WATER OF THE VOLGA HYDRO-ELECTRIC STATION. (O SKOPLENII SHCHUKI V NIZHNEM B'EFE VOLZHSKOI GES.) M. Rybnoe, No. 3, March, pp. 15-16.

From 1956-1958, the All-Union Scientific Research Institute of Fisheries of Lakes and Rivers has conducted observations on the population and concentration of fish in the tail-water of the Volga hydroelectric station. The fish inhabiting the locale were a variety of carp, sturgeon, white salmon, and sterlet. In fall, 1956, pike began to descend from the Kuibyshev reservoir and continued coming in great numbers for two years, upsetting the peaceful regime in the tail-water. By 1958, pike concentration reached 70% and 90% by weight.

In addition to controlled catches, 60 mm capron stationary nets were applied with good results. With a 300-meter net, set out April 22 through May 4th, 1958, 1600 kg pike were caught, and from September 26-October 4, 3,000 kg of the fish were hauled. On October 3, with a 400-meter net, 48 pike were caught, but with these came also 18 sturgeon breeders.

It is important that pike catches be under strict control by the Fisheries Conservation Commission. Control catches should be carried out at least eyery 7-10 days. With proper organization, large quantities of pike can be caught without detriment to the concentration of the valuable migrating fish. (R. G. K.)

2972. Guseinov, M. SH. 1959. SELECTION OF BREEDERS AND SECURING RIPE STURGEON ROE. (OTBOR PROIZVODITELEI I POLUCHENIE ZRELOI IKRY OSETROVYKH.) M., Rybnoe Khoziaistvo, No. 4, April, pp. 19-22.

For pisciculture purposes, the success of artificial fertilization lies in the selection of qualitative breeders and in securing the roe. Breeders should be selected in spring, before the "fatty sturgeon" appears and when the water temperature in Kura River reaches 13-14°.

Spring sturgeon breeders should be transplanted from April 1 to the beginning of May. In the case of extreme necessity, breeders can be provided during the first ten days of May, but not later; spring sturgeon are seldom found in catches of May 15-20. For selection, males should be thinner and more active than females.

Selected breeders, delivered to the plant, are numbered, weighed, measured, then placed in a pond. A female's readiness for hypophysis injection is recorded and the most mature selected for securing the roe. Female injection should be calculated so that roe ovulation would come at a suitable work period: 8-9 a.m. Symptoms of maturity in fish can serve as guide in selecting desired breeders from ponds when the water temperature is 14-23°.

Hypophysis solution is injected into the muscles in two places. Due to injection, males mature earlier than females, so they should be injected a few hours later than females.

Breeders should be kept in separate ponds. After injection, they should be placed together. Examination of breeders for the first time should take place 3-4 hours after injection.

Males can be used for artificial fertilization several times. On the Kura experimental plant males are injected 2 and 3 times at intervals of several days.

The roe of one female is fertilized with the sperm of two and three males. The sperm of each male is kept separately. (R. G. K.)

2973. Askhaev, M. G. 1959. ON PISCICULTURE MEASURES OF UTILIZING THE IRKUTSK RESERVOIR. (O RYBOVODNYKH MEROPRIIATIIAKH PO OSVOENIIU IRKUTSKOGO VODOKHRANILISHCHA.) M., Rybnoe Khoziaistvo, No. 4, April, pp. 41-44.

With the construction of the Irkutsk hydro-electric station in 1958, the first artificial reservoir was formed on the Angara River.

The reservoir basin was not uniformly filled, resulting in fluctuations in water level and a broken shore line. There are at present more than 20 bays,

some reaching 17 m. The reservoir receives more than ten river tributaries, the larger ones being important as spawning grounds for Thymallus, Hucho perryi, Brachymystax, etc.

The water entering from the Baikal has a temperature range of 1.5-12°. During the summer, the water in the reservoir is heated on the surface to 17.5°, in the bays to 22°, and in the shallow stretches to 25°.

For acclimatization, 4500 breeders of Abramis brama were introduced from Ubinsk Lake between 1956-1958. In 1957, 330 breeders of Cyprinus carpio were transplanted from Amur, 6.5 million omul' larvae from Baikal and about a million of Baikal Coregonus.

Young Thymallus, pike, perch, and carp form large concentrations from May to the end of August. When the water becomes colder, these fish go into the deep waters of the bays for the winter. Before the dam was constructed, many of these fish came to Angara River from Baikal for fattening during the summer and returned to Baikal in October. Some of these fish may remain here permanently now. Among them are undesirable predators.

From proper utilization and management of the Irkutsk reservoir it is essential: (1) to broaden the volume of fishery experimentation, (2) to define clearly the composition of the ichthyofauna by biological and morphological study of all fish, (3) continue the work on acclimatization of the fish already introduced, (4) organize spawning-rearing fisheries for all salmon forms, (5) conduct hydro-amelioration work on spawning rivers, (6) carry out biological amelioration in suppressing the number of predatory fish, (7) check existing rules for amateur fishing and commercial catches on the Angara River, (8) prevent pollution of the reservoir. (R.G.K.)

2974. Azbelev, V. V., G. D. Gromov, and I. I. Lagunov. 1958. EXPERIMENT IN STOCK-TAKING OF SALMON ON THE KOLA PENINSULA. (OPYT UCHETA SEMGI V REKAKH KOL'SKOGO POLUOSTROVA.) M., Rybnoe Khoziaistvo, No. 2, Feb., pp. 22-24.

The primary problem of the Murmansk Fishery has been the improvement in reproduction of salmon. Included in this problem is the constant search for better methods of calculating the supply of salmon and to determine the percentage of permissible catches of individual groups.

Little has been accomplished in this direction on the Murmansk rivers. The results of isolated cases do not offer any guide as to perfecting regulations of catches.

The outcome of each season's hauls depends on a series of climatic and organizational factors. Annual changes in the number of the commercial and productive part of the salmon population, migrating to the Kola Peninsula, do not correspond with the changes in the number of the reproductive part of salmon. This limits the use of statistical catches. And the number of this reproductive part of the group reflects better the number of the entire migrating population than data on catches.

Comparative data on the number of migrating groups show that the salmon of the Kola rivers retain stability after catches averaging 25% of the population, whereas the number of Kolva-river salmon shows an increase after catches averaging 46% of the population. To determine whether this is the result of a higher regenerative capacity of Kolva salmon, the basic signs characterizing the regenerative capacity of the individual groups must be compared.

The average fecundity of Kola salmon is 12,200 eggs, that of Tuloma is 10,400 eggs, and that of Kolva is only 8,500 eggs. From 4.2 - 13.9% of the races of Kola salmon survived to spawn again, but in the Kolva groups only 0.3-2.6% survived. The survival to the third spawning migration among Kola salmon was insignificant, but it showed 0.4% per generation. No such survival has been observed with Kolva salmon. On the other hand, the shorter fresh-water period is more favorable to the reproduction of Kolva salmon. The average age of the Kolva "roller" is 2.5 years, the average age of the Kola "roller" is 3.2 years. It should be pointed out that also by absolute age the Kolva salmon migrants are younger than the Kola migrants. Therefore, the Kolva population should react faster to improved conditions of reproduction. And such conditions exist. Since 1949, breeders on the way to spawning have been going through an artificially-created current, by-passing the waterfall, and have been well preserved.

In perfecting salmon count, it is advisable to refer to the method of salmon calculation used in the Far East where records are kept of breeders and the young. Such information would offer scientific basis for the construction of a flexible system of regulating catches. (R.G.K.)

2975. Dudkin, A. D. 1959. EXPERIMENT IN TRANSPORTING TROUT BREEDERS A LONG DISTANCE. (OPYT TRANSPORTIROVKI PROIZVODITELEI FORELI NA DAL'NEE RASSTOIANIE.) M. Rybnoe Khoziaistvo, No. 1, Jan., p. 31.

In 1958, the Ukranian State Fishery transported, by automobile, from Kursk to the Transcarpathian region, 160 breeders of rainbow trout (100 females, 60 males).

April 17, at 8:00 o'clock, the fish, weighing 700 grams, were placed in a tank 3.8 m^3, so that there were 23 lit. of water to an individual, or 32 lit. to 1 kg of weight of live fish.

The tank was completely filled with spring water from the fishery pond and hermetically sealed. On the road the water was ice-cooled to 10-12°. Every 40-60 minutes it was aerated by a special attachment and fresh air admitted during 15-20 minutes.

April 18, at 9:00 o'clock, the trout were delivered to Kiev, transferred to three wooden tanks and placed in a pond fed by ordinary river water. The distance from Kursk to Kiev, 700 km., was completed in 25 hours. During this trip only one male perished.

April 20, at 9:00 o'clock, the trout breeders were again placed in a transportation tank filled with pond water, cooled and aerated. From Kiev they were shipped to the Svalava Trout Fishery, in the Trans-

carpathian region, a distance of 800 km. One trout perished during this trip.

All fish reached their destination in good condition, without any injury. On the day of arrival, 12 thousand high quality eggs were obtained from four females and fertilized. The following day, 180 thousand eggs were obtained from all 100 females and set for incubation. (R. G. K.)

2976. Abdurakhmanov, IU. A. 1958. EFFECT OF THE REGULATED KURA RIVER OUTLET ON THE BEHAVIOR AND NUMBER OF FISH IN UNDER WATER OF THE MINGECHAURSK HYDRAULIC STATION. (VLIIANIE ZAREGULIROV ANNOGO STOKA R. KURY NA POVEDENIE I CHISLENNOST' RYB V NIZHENEM B'EFE MINGECHAURSKOI GES.) M., Rybnoe Khoziaistvo, No. 12, Dec., pp. 13-15.

Since the construction of the Mingechaursk reservoir, conditions in the Kura River below the dam have been drastically changed.

Until the construction of the dam 32 varieties of fish forms had been observed. Among these were: salmon, sturgeon, Acipenser stellatus, Acipenser nudiventris, pike perch, lamprey, and Caspian barbus and other carp, all of which comprised 73% of the fish population in the river. Since the construction of the dam, these have reduced to 40%, and many have disappeared entirely.

Chalcalburnus chalcoides, who prefer the cleared water in the Kura River, continue to come and spawn below the dam. But due to the change in regime of the water temperature, C. chalcoides changed their spawning period from the beginning of the summer to the second half of summer and fall, or from July through September. Lamprey spawn from the end of May to the end of June. Successful spawning is substantiated by the large numbers of lamprey bottom larvae and by the quantities of C. chalcoides young in the water.

Salmon could not go up to their natural spawning grounds in the Kura River tributaries and stayed in reservoir outflow, where the temperature was lower. During October, 1955, female salmon were found in stages close to maturity.

Sturgeon also reduced in number. The main reason is probably the clearing of the water in the Kura River; they normally spawn in muddy waters. It is also possible that the lower water temperature adversely affected sturgeon, which normally propagate in warm waters.

So the main sturgeon population, coming from the seas, enters the muddier waters of the Araks River, a tributary to the Kura River.

At present there is in construction a fishery station which will include artificial spawning grounds, ponds and basins, and experimental facilities. (R. G. K.)

2977. Diuzhikov, A. T. 1958. MARKING AND TRANSFER OF STURGEON FROM UNDER WATER OF THE KUIBYSHEV HYDRAULIC UNIT TO A BASIN. (MECHENIE I PERESADKA OSETRA IZ NIZHNEGO B'EFA KUIBYSHEVSKOGO GIDROUZLA V VODOKHRANILISHCHE.) M., Rybnoe Khoziaistvo, No. 11, Nov., pp. 20-21.

In 1956, the Kuibyshev State Fishery transferred sturgeon from waters below the Kuibyshev hydraulic unit to waters above. The fish comprised 843 sturgeon, 800 sterlet, some white sturgeon and a few Acipenser stellatus. Most of these were small and sexually immature.

Assuming that all fish 100 cm long are sexually mature, then 222 sturgeon breeders were transferred.

The large number of marked sturgeon in the basin offered the opportunity to observe the fish at close range. The behavior of migratory sturgeon transferred to a basin is a problem to be carefully studied: is it expedient to pass the fish to the upper water of the Volga hydraulic unit. (R. G. K.)

2978. Bazarova, G. P. 1958. ON THE RESTORATION OF FISH STOCK IN LAKE KHANKA. (O VOSSTANOVLENII ZAPASOV RYB V OZERE KHANKA.) M., Rybnoe Khoziaistvo, No. 4, April, pp. 14-15.

Lake Khanka is a large, fresh-water basin in the Far East, and claims more than thirty varieties of fish, many of commercial value. For the past few years the supply has diminished.

The decline in stock is ascribed to the growth of the fish industry and to the newly created rice fields. Canals and overgrowth in ditches have been instrumental in hampering fish movement, so that the fish, unable to travel to rivers and lakes, often land in pits, remain there for the winter, die of starvation and freeze.

The swamps in Khanka lowlands must be cleared. To avoid fish loss and destruction, the lake must be stocked with young and valuable fish.

Rice fields serve as good fattening grounds for certain young fish. Such area is also conducive to the development of organisms which again serve as food for fish. Fish, in turn, are good for rice fields, for in their search for food the fish loosen the soil.

Lake Khanka can be stocked with valuable fish, for there are very few mud and predatory fish in it. We need high-quality fish products in order to replenish Lake Khanka, which is a naturally rich corner of the Far East. (R. G. K.)

2979. Zhuravel', P. A. 1958. ON THE INTRODUCTION OF NEW FOOD FORMS FOR FAUNA FISH INTO THE SIMFEROPOL' BASIN. (O VSELENII NOVYKH VIDOV KORMOVOI DLIA RYB FAUNY V SIMFEROPOL' BASIN.) M., Rybnoe Khoziaistvo, No. 9, Sept., pp. 28-29.

Research has shown that contemporary fauna in the Crimea is impoverished. This condition is ascribed to drought.

The Crimea basin has favorable conditions for the life of representative fauna fish and feeding invertebrates, all of which are lacking in the rivers feeding these basins.

Since 1955, new fish forms and food for them have been introduced into the Simferopol' ponds and basins. A series of feeding organisms from fresh-

water fauna were first introduced, also fauna of estuary composition of the "Caspian" type, then small quantities of fooding organisms caught in the Dniepr, Samara, Karachunov basin, and the Dniepr estuary.

The Dniepr Institute of Hydrobiology of the State University has conducted tests since 1955 on the introduction of new fish forms and food into this basin. Sufficient data has been collected to give the following results:

Some of the organisms introduced have already taken root. Judging by their multiplication and by the number consumed by the fish, these organisms are well settled all along the basin, and of those in abundance are Limnomysis benedeni. The Crimea Fish Economy and the Educational Institute are together conducting tests and working on further improvements. (R. G. K.)

2980. Tanasiichuk, V. S., and P. N. Khoroshko. 1958. ON STURGEON SPAWNING BELOW STALINGRAD IN CONNECTION WITH THE CONSTRUCTION OF ARTIFICIAL SPAWNING GROUNDS. (O NERESTE OSETROVYKH NIZHE STALINGRAGA V SVIAZI S USTROISTVOM ISKUSSTVENNYKH NERESTILISHCH.) M., Rybnoe Khoziaistvo, No. 9, Sept., pp. 18-20.

Sturgeon spawning below Stalingrad has been studied since the Stalingrad hydroelectric station was constructed in 1952. The dam has cut the access of migratory fish to spawning grounds located higher up, and sturgeon coming to spawn in the Volga concentrate below the dam.

Sturgeon spawn on stony stratum of which there are few below Stalingrad. There have been suggestions of white sturgeon spawning the lower Volga. This fish has been found in that region, on gravel ground, at a depth of 9 m., and at water temperatures of 9-9.6°. The diameter of the located roe was 3.4-4.4 mm.

Judging from the dates of the roe and the stages of development, white sturgeon spawning began the first or second of May, at 21.5°. There was also the possibility of spawning in the Volga delta and of sturgeon maturing there. But this is doubtful, since there are not any substrata suitable for spawning in the section. Catches of 7-10 day old larvae do not prove the existence of spawning below Astrakhan, for in strong and speedy currents larvae can be carried downstream long distances. In June, more larvae were found averaging 19-22 mm. long. But these could have been of non-local origin.

The main sturgeon population spawns in central Volga, summer and winter.

In 1957, no roe or larvae in early stages of development were found below Stalingrad. Two larvae, 12.2 and 18.2 mm., were found on the 26th of June near Kamennyi Iar, and a few females with roe were located in Beluga and Kirov Shoals.

Sevriuga, Acipenser stellatus, spawning grounds extend from Svetlyi Iar to Stalingrad, and developing roe was found in Dubovka River and Kamennyi Iar in 1957. At the same time, hatched larvae, but no fertilized roe, were found in the lower Volga.

Rapid current and stony or gravel bottom are requisite for successful sturgeon spawning, so artificial spawning grounds are essential. (R. G. K.)

2981. Shishkova, E. V. 1958. ON FISH REACTION TO SOUND AND TO NOISE SPECTRA OF A TRAWLER. (O REAKTSII RYBY NA ZVUK I SHUMOVYKH SPEKTRAKH TRAULERA.) M., Rybnoe Khoziaistvo, No. 3, March, pp. 33-39.

Fish reaction to various sounds has been studied little. But even on the basis of a few experiments we have some idea on the subject.

A stress from the sound generator to the hydroacoustical transmitter, submerged in the water, frightened the fish at the first moment of reaction and caused them to withdraw deep into the water, but they came up again, quickly adapted themselves and ceased to react to repeated sounds.

Fish reaction is stronger to sounds of alternate tones and changing level than it is to monotonous sound, to which the fish adjust quickly.

There is little data on the ability of fish to locate sound, but an analogy can be drawn. Keenness of perception is finer, the more varied the time in sound. Large fish, possessing a larger acoustics base, i.e., having a larger distance between organs, receiving sound pressure, are more likely to have the capacity to determine sound direction than small fish. The small fish, dashing into the deep at the sensation of sound, know no other direction, this movement being a reaction of self-preservation. Even when the sound penetrated deeper into the water, the tested gray mullet (35 cm long) stayed in the deep.

Tests on anchovy in the Kerchensk Bay gave the same results. Neither anchovy nor mullet deviated sideways, which proves that they did not react to sound direction.

The tests were performed from two boats with recording outfits. Trawler noises were registered at various conditions: the noise spectra created by the trawler for different movements of its course; the noises made by a moving fish group, and the ship's movement by inertia. The spectra covered 40-4000 frequency units.

Comparing the noises created by a trawler with the hydrodynamic noises caused by a group of moving fish, it is possible that the noises felt by the fish in the immediate vicinity conceal, in some degree, the noises of a boat. And comparing the trawler spectra with those of the fish, it has been found that the hydrodynamic noises of a fish group have less intensity and a different frequency composition from the frequency composition of a trawler.

The noises perceived by the fish coming from their own group are not similar to the noises of a boat, and the fish cannot help being affected by it. (R. G. K.)

2982. Protasov, A. A., and L. L. Kozlova. 1958. EMPLOYING DWARF MALE SALMON IN FISHERIES. (PRIMENENIE KARLIKOVYKH SAMTSOV LOSOSIA NA RYBOVODNYKH ZAVODAKH.) Rybnoe Khoziaistvo, No. 10, Oct., pp. 21-25.

In the fall of 1955, about 700-thousand eggs

were obtained from females raised in the ponds. Of these, 84.2 thousand were fertilized with the milt of large males. The rest of the roe was fertilized with milt of dwarfs of various ages. The dwarf male salmon, kept at the Chaikend fishery station, were hatched in 1951, 1952, and 1953.

The roe of each female was fertilized with the milt of one or more males. The milt of the several males was mixed before using. In all cases, fertilization was carried out by the regular dry method. The roe, washed to remove excess milt, was kept in changing water for 40-50 minutes and when swollen was placed for incubation in separate Schuster apparatus.

In March of 1956, 335,335 larvae, 54-60 days old and weighing 120-150 mg., were actively feeding. The year's crop was raised in metallic pans.

In June, when the young reached the average weight of 500 mg., they were transferred from the pans to circular basins, 45 m. in diameter. The density of the setting was 6-10 thousand to a basin. The young were kept in the basin to the yearly stage.

Feeding rations were at first 15% of the weight of the young, three times a day, later it was 10%, four times daily.

This study showed that, in the absence of a sufficient quantity of high-quality milt from large migrating males, the milt of dwarf males can be used. It is sufficient to have at the plant 100 dwarf males to fertilize successfully one million eggs.

Our data prove that the young of the year's crop, obtained from roe fertilized with milt of dwarf males, have the same or similar weight as the young obtained from roe fertilized with milt of large migratory males. (R. G. K.)

2983. Olifan, V. I. 1957. ON THE 24-HOUR FEEDING RHYTHMS OF THE FRY OF BAYKAL GRAYLING, AND ON THE 24-HOUR RHYTHMS OF FISH FRY IN GENERAL. (O SUTOCHNYKH RITMAKH PITANIYA MAL'KOV BAYKAL'SKOGO KHARIUSA I O SUTOCHNYKH RITMAKH U MOLODI RYB VOOBSHCHE.) Doklady Akademii Nauk SSSR, Vol. 114, No. 3, pp. 669-672.

The problem of the rhythms- and particularly of the rhythms within twenty-four hours - in the physiology and behavior of animals arouses great interest. Intensive studies of this subject were started during recent years. The rhythms of the life and daily activities of fish, however, are not well known. In this context, the author of the paper under review wants to report on his observations at Lake Baykal. The experimental fry, weighing 65-300 mg, came from an auxiliary reservoir of the Bol'shaya River (this river flows into Lake Baykal). The fry was observed through an uninterrupted period of 24 hours, and particular attention was given to the way the fry was fed on the numerous small crustaceans (moinae, daphniae, zycops) in their aquarium. Every five minutes, the number of crustaceans eaten was noted. The results of these observations are represented by curves in Figure No. 1 of the paper under review. From an analysis of the data available in the relevant scientific publications the author of the present paper comes to the following conclusions: (1) The 24-hour feeding and breathing rhythms have been determined by several authors with regard to different fish; (2) these rhythms vary from fish to fish: some have two maxima, others three or even four, but in almost all species of fish investigated the morning and evening hours represent periods of highest feeding and breathing intensity. In the light of the above, the conclusion by Vinberg that "there does not exist and cannot exist any definite type of variation in daily metabolism common to all fish" must be considered as erroneous. Vinberg's criticism of an earlier paper by the author of the present paper does not hold ground. The papers of other authors to which Vinberg refers show a series of methodological inaccuracies. There are 1 figure and 17 references, 13 of which are Soviet. (SOV/STEP 20-114-3-60/60)

2984. Gun'ko, A. F. 1958. THE INFLUENCE OF THE FLOW IN A RESERVOIR ON THE STATE OF THE BENTHIC FAUNA (AS OBSERVED IN THE GOR'KOVSKOYE RESERVOIR). (VLIYANIYE PROTOCHNOSTI VODOKHRANILSHEHA NA SOSTOYANIYE DONNOY FAUNY (NA PRIMERE GOR'KOVSKOGO VODOKHRANILISHEHA).) Doklady Akademii Nauk SSSR, Vol. 119, No. 2, pp. 372-374.

In order to be able to make universal economic use of the reservoirs now in the process of development, at present much attention is paid to the development of their fauna (References 1-5). For a few years the author has investigated a section of the Volga in the zone of dam of the Gor'kiy power plant with regard to the modification of the bottom fauna and its trend of development. The mentioned reservoir, 434 km of length and of a capacity of 10.3 km^3, began to fill up in October 1955. The water level rose by 6 m; in spring of 1956, by another 8m; and by a further rise of 4m the filling up was finished. Already the first rise had slowed down the flow by 60%. Mud and fine loam deposits on the whole surface were intensified by further damming up. The developed reservoir was divided into two parts with regard to the speed of flowing through: (a) without flowing through and with weak flowing through with velocities up to 15 cm/second and (b) with flowing through velocity exceeing 15 cm/second (former bed of the Volga, starting from 40-50 km upstream of the dam). The modified hydrological regime has determined the direction of development of the bottom fauna. During the first winter after the damming up and in the first half of the summer the psammophil and rheophil complexes of the river fauna could keep alive (table 1). From the middle of June 1956 the modification of the psammophil complex of the organisms, which so far had covered 90% of the area of the river, became clearly evident. Cryptochironomus - larvae (highly rheophil) almost entirely disappeared. Also the larvae of the Hydropsyche ornatula (lithorheophil) disappeared. At the end of June the colonization of the developed biotopes began. At first it took place near the banks, spread-

ing across the entire reservoir surface towards the end of July. The character of the colonization was essentially influenced by the velocity of flowing through. Towards August all biotopes without or with weak flowing through, in spite of their different original condition (meadows, fields, forests and so on), were densely colonized by larvae of chironomidae (Tendipes) (up to 5610 larvae of a total weight of 23.7 g/m^2). In submerged bushes there were also Endochironomus and Procladius. Only the former bed of the Volga in which the flowing through had been maintained remained untouched by this process. Neither then nor later chironomidae and others of the mentioned kinds have appeared here. The chironomidae Tendipes furthermore determined the dynamics of the living mass of the benthos of the biotopes without flowing through; they were the main part of the bottom fauna. In the biotopes with flowing through only one atrophied complex of the river fauna remained alive during the whole season of the open water (table 1, figure 1). On the whole the average living mass of the bottom fauna of the wide part of the reservoir has considerably increased at the expense of the biotopes with no or weak flowing through during the first year. The mentioned modifications will have an influence on the development process of the shoal centers in the reservoir. There are 1 figure, 1 table, and 5 references, all of which are Soviet. (SOV/STEP 20-119-2-51/60)

2985. Zorina, A. 1959. A SUBMARINE LABORATORY. (PODVODNAYA LABORATORIYA). Nauka i zhizn', 1959, No. 2, pp. 17-18 and p. 2 of centerfold.

This article deals with the construction and equipment of and the tasks to be performed by the submarine "Severyanka", the "submarine laboratory". On December 1958, the vessel put to sea for its shake-down trip. On board the ship was an expedition of the Vsesoyuznyy nauchno-issledovatel'skiy institut morskogo rybnogo khozyaystva i okeanografii (All-Union Scientific Research Institute of Sea Fishing and Oceanography). The ship is equipped with the newest Soviet apparatus. All the water surrounding the hull is surveyed by highly sensitive hydroacoustic devices. With their aid the ichthyologists can determine the distribution and approximate outlines of fish schools. The submarine has three illuminators; two on starboard and port, and one which is directed upwards. The "Severyanka" has two sounding apparatus with self-recording waves upwards, to the surface of the sea, the other down, to the sea bottom. The reflected signals immediately inform the scientists of the appearance of fish or other marine organisms. An electronic thermosalinometer determines the temperature and salt content of the water, and a special device for taking water permits its analysis and measuring for radioactivity. One of the main tasks of the submarine is the finding and tracing of shoals, a task whose importance is demonstrated by the fact that the Soviet Union wants to increase her catches from 29 million centners in 1958 to 46 million centners in 1965. The team is also concerned with geological, oceanological and other research. During their cruise, the scientists could observe molluscs, medusae, etc., through the illuminators at a distance of 10-20 m. Three times the boat went to the sea bottom. In 1959, the "Severyanka" will carry out several scientific expeditions into the fishing areas of various seas and oceans. For its second expedition the ship went out to the Atlantic into the Soviet fishing areas. There are two drawings and one photograph. (SOV/STEP 25-59-2-6/48)

2986. Lebedeva, G. D., and S. G. Sinevid. 1958. THE EFFECT OF RADIOACTIVE STRONTIUM UPON THE SURVIVAL RATE AND UPON THE PROPAGATION OF DAPHNIA MAGNA. (DEYSTVIYE RADIOAKTIVNOGO STRONTSIYA NA VYZHIVZYEMOST'I RAZMNOZHENIYE DAPHNIA MAGNA.) Doklady Akademii nauk SSSR, Vol. 122, No. 4, pp. 586-588.

According to previous results of the authors (Ref. 3), there is a group of plankton organisms which very intensely accumulates radioactive isotopes. The authors, therefore, investigated the chronic effect of radioactive substances (various concentrations of Sr^{90} - Y^{90} upon the survival rate and upon the propagation of Daphnia magna for a series of generations. For these experiments, Daphnia magna was especially grown in laboratory conditions at a temperature of 18-20°. Forty females of Daphnia were placed into half-liter glasses containing Sr^{90} of a concentration of $3,4.10^{-10}$ to $3,4.10^{-3}$ Cu/l. The carrying out of the experiments is discussed. These concentrations of Sr^{90} did not cause any visible sharp morphological changes, neither in the initial specimens, nor in the following generations. The above discussed experiments gave the following results: (1) A concentration of $3,4.10^{-10}$ Cu/l of Sr^{90} has no influence upon the life of Daphnia magna, but it slightly increases the quantity of the progeny. (2) Sr^{90} concentrations of from $3,4.10^{-7}$ to $3,4.10^{-3}$ Cu/l increase the number of the progeny within the first two weeks, and then a suppressing effect follows. (3) In the experiments with a concentration of $3,4.10^{-3}$ Cu/l a progeny came only from the initial organisms. This progeny died after one week. (4) The life of Daphnia organisms is reduced to 10 - 16 days by Sr^{90} concentrations of $3,4.10^{-5}$ and $3,4.10^{-4}$ Cu/l. Under the influence of a Sr^{90} concentration of $3,4.10^{-3}$ Cu/l, even the initial Daphniae died two weeks after the beginning of the experiment, and its progeny - after one week. (5) Sr^{90} concentrations from $3,4.10^{-10}$ to $3,4.10^{-3}$ Cu/l do not cause visible morphological changes of Daphnia magna. There are two figures and five references, five of which are Soviet. (SOV/STEP 20-122-4-12/57)

2987. Sorokin, Yu. I., and O. I. Koblents-Mishke. 1958. THE PRIMARY PRODUCTION OF THE JAPAN SEA AND OF THE PART OF THE PACIFIC OCEAN NEAR JAPAN IN THE SPRING 1957. (PERVICHNAYA PRODUKTSIYA YAPONSKOGO MORYA I CHASTI TIKHOGO OKEANA, PRILEGAYUSHCHEY

K YAPONII, VESNOY 1957 G.) Doklady Akademii Nauk SSSR, Vol. 122, No. 6, pp. 1-18-1020.

From April to June 1957 the expedition ship "Vityaz'" of the Institut okeanologii Akademii nauk SSSR (Institute for Oceanology of the Academy of Sciences USSR) sailed on her 24th voyage in the Japan Sea and in that part of the Pacific which is near Japan. During the entire voyage primary production was investigated in a water column under 1 m^2 of the surface by the radioactive carbon method. The results obtained by a provisional qualitative evaluation of the phytoplankton collected (carried out by V. V. Zernova), made it possible to compare the phytogeographical characteristics of the waters investigated. The region investigated may be subdivided into four parts: I. The western part of the Japan Sea. II. The eastern part of this sea. III. The part of the Pacific which is located north of 40° north latitude. IV. The part of the Pacific which is situated south of 40° north latitude. Part I. - the waters of the cold coastal current and of the chalistatic region of the Japan Sea, is inhabited by arctic-boreal and boreal forms. In Part II, in the cold Tsusima-current, also tropical forms were found besides boreal ones. Part III is situated in the zone of mixed waters of various origin: the cold Oyasio-current and subarctic waters. This Part III is characterized by a variety of distribution of the temperature and the salt content in the horizontal as well as in the vertical direction. Some "cold spots" are places at which water rises from the depths to the surface. The phytoplankton of this region consists of arctic--boreal and boreal forms. Near the island of Hokkaido great masses of neritic species such as Thalassiosira nordenskioldi develop. In Park IV the species which characterize the mixed phytoplankton zone predominate. Data concerning primary production and the conditions of observation are given by a table. Primary production varied between 2 mg and 5 g of organic carbon, which was produced in the water column under 1 m^2 of the sea surface per day. The causes to which these differences in production in the various regions are due are mentioned. The authors thank V. V. Zernova and V. S. Malevanov who assisted in the investigations discussed here, and they also express their gratitude to the hydrological and chemical collaborators who took part in the 24th voyage of the "Vityaz'". There are 1 figure, 1 table, and 4 references, 3 of which are Soviet. (SOV/STEP 20-122-6-17/49)

2988. Smirnov, A. I. 1958. SOME PECULIARITIES OF THE BIOLOGY OF PROPAGATION AND THE DEVELOPMENT OF THE SALMON SUBSPECIES NERKA - ONCORHYNCHUS NERKA (WALBAUM). (NEKOTORYYE OSOBENNOSTI BIOLOGII RAZMNOZHENIYA I RAZVITIYA LOSOSEVOY RYBY NERKI - ONCORHYNCHUS NERKA (Walbaum).) Doklady Akademii Nauk SSSR, Vol. 123, No. 4, pp. 371-374.

The subspecies mentioned in the title is a very valuable object of fishery. In spite of numerous studies (Refs. 1-4) data on its development are scarce. Nerka is bred in Kamchatka and on the Kuril'skiye Islands. Thanks to the cooperation of F. V. Krogius and Ye. M. Krokhin, the author was able to study the development of Nerka at the Paratunskiy Point of the Kamchatskoye otdeleniye Tikhookeanskogo instituta morskogo rybnogo khozyzystva i okeanografii (Kamchatka Branch of the Pacific Institute of Maritime Fishery and Oceanography) on Lake Dal'neye in the catchment area of the river Paratunka. The exceptional variability of Nerka within the subspecies is especially characterized by its fecundity and the size of eggs (spawn): the early spawning type lays 3600, the late spawning type (called azabach) 4500 eggs on the average. The male Nerka produces a relatively dilute sperm in small portions considerably inferior in quantity to that of the other salmon subspecies (keta, gorbusha) (Ref. 5). It is possible to obtain a biologically valuable sperm from one male Nerka up to eight times. Lakes as spawning places are typical for Nerka. In brooks, places with a slow current are preferred (0, 1-0, 2 m/sec.). The location of the spawning places must in any case be near spring water. In this case the oxygen content is low (down to 3, 55 mg/l) whereas the carbon dioxide content is high. In captivity the Nerka spawn endures also an oxygen content of 2, 7 mg/l (Ref. 8). The author has carried out spawn incubation under various conditions and has observed hatching after 55 days at 11, 4° and after 148 days at 4, 6°. This is longer than in the case of a number of other Pacific salmons. The hatching period is very long. The young fish change over to independent alimentation earlier than those of other subspecies. Nerka is in various ways equipped for an existence under bad conditions of air supply: the smallest eggs with thin shell among related types, red-orange color of the eggs that tends to show a high content of carotenoid pigments. Carotenoids are oxygen carriers and catalysts of redox processes. The netting of capillaries of the embryo is very fine; finally the active movements of the embryo start already at the blastodisc stage. Later the movements of muscles begin and intensify till they bring about a turn of the embryo in the egg membrane. Fish breeders, however, must not forget that in the case of Nerka the vascular net of the vitelline sac shrinks during the last period of incubation just at a time of increased need of oxygen of a now big embryo. It is necessary to provide a good flowing through in containers with Nerka spawn during this time. There are one figure and 11 references, nine of which are Soviet. (SOV/STEP 20-123-2-46/50)

2989. Movchan, V. A., and M. F. Polivannaya. 1958. THE NATURAL FOOD RESOURCES AND THE ICHTHYOFAUNA OF THE DONBAS RESERVOIRS. (YESTESTVENNYYE KORMOVYYE RESURSY I IKHTIOFAUNA VODOKHRANILISHCH DONBASSA.) Dopovidi Akademii Nauk Ukrains'koi RSR, 1958, No. 2, pp. 224-227.

The piscicultural use of the reservoirs in Donbas has heretofore been carried out without proper scientific foundations. To remedy this omission, the Ichthyology Chair of the Kiyev State University

conducted for four years a study of eight reservoirs of the Stalino Oblast' with a total area of about 3,000 ha. These reservoirs, which were built at different times after 1931, are characterized by small dimensions and depths, high mineralization of the water, and intensive development of plankton which is not fully utilized by the fish (the residual plankton biomass during the vegetative period amounts to 7 to 15 g per cu m). The benthonic fauna is consumed by the fish at a great rate, and its residual biomass amounts to 4 to 7 g per cu m. It is expedient to maintain at a high level the numbers of bream, carp, pike perch and Prussian carp, with carp predominating in the Kurakhovskoye, Mironovskoye, Yenakiyevo, Luganskoye reservoirs and bream predominating in the Karlovskoye, Kleban-Bykskoye and Starokrymskoye reservoirs. High fish production from the Donbas reservoirs can be attained provided that a fish nursery is established to supply the reservoirs with these species, and the possible catch of certain fish species is limited in accordance with the supply. There are three tables. (SOV/STEP 21-58-2-26/28)

2990. Corbella, Carla, and Vittorio e Livia Tonolli. 1958. I SEDIMENTI DEL LAGO D'ORTA, TESTIMONI DI UNA DISASTROSA POLLUZIONE CUPRO-AMMONIACALE. Memorie Dell'Istituto Italiano di Idrobiologia, Vol. X, pp. 9-50. (In Italian with English summary)

The Lago d'Orta, in Northern Italy, about 20 km from Pallanza, has become a heavily polluted lake, because of the effluent, very rich in copper and ammonia, which a factory of artificial silk discharges into the lake. This poisoning started some thirty years ago and has never been interrupted, although in recent years technical improvements have reduced the copper concentration in the effluent. The dilution of the latter in the large mass of lake water (the lake volume is 1.308 million cu. m.) has had no beneficial effect, as the water renewal is very slow, 11 to 12 years being required for the theoretical complete replacement. The pollution has been all the more harmful in that the polluting factory is situated at the southern end of the lake, the polluting matter being thus obliged to pass through the whole length of the lake before reaching the outflowing river at the northern extremity.

The toxicity of the wastes discharged into the lake had immediate effects: two years after the factory had started work the whole of the plankton, benthos and fishes had been killed.

In the last few years some algal life had reappeared, and littoral growth can be found near the entrance of inflowing streams.

The water of the lake has been analyzed and cores of sediment have been taken at nine different stations along the main axis of the lake. The cores were cut into 1 cm slices, which were studied both from chemical and biological points of view. (Auth. summ.)

2991. Tonolli, Vittorio. 1958. RICERCHE SULLA MICROSTRUTTURA DI DISTRIBUZIONE DELLO ZOOPLANCTON NEL LAGO MAGGIORE. Memorie Dell'Istituto Italiano di Idrobiologia, Vol. X, pp. 125-152. (In Italian with English summary)

This paper deals with the patchiness of zooplankton organisms, as studied in Lake Maggiore (Northern Italy). An apparatus for continuous, quantitative plankton sampling is described. Six courses have been analyzed and the resulting countings of pelagic crustaceans are reported.

Superdispersion is shown to be the quite general pattern of distribution. A very sharp correlation has been shown between the numbers of large predator Cladocerans (Leptodora and Bythotrephes) and the numbers of all the other crustaceans.

Different organisms very often manifest variations in their spatial densities simultaneously, which may be considered as an effect of external forces acting through the water. Some varitions, however, appear independently and the perturbating agent is supposed to be here a biological one, acting inside a species or a stage. (Auth. summ.)

2992. Hutchinson, George Evelyn. 1959. IL CONCETTO MODERNO DI NICCHIA ECOLOGICA. Memorie DellIstituto Italiano di Idrobiologia, Vol. XI, pp. 9-22. (In Italian with English summary)

Using a system of n coordinates, it is possible to define the concept of the niche in such a way that the Volterra-Gause principle, that two coexisting species do not occupy the same niche, is an inductive non-tautological generalization, susceptible to verification or falsification. The generalization applies only to equilibrium states. Where it appears not to apply, it is probable that equilibrium is never achieved. Models, giving the probable distribution of numbers of individuals of a series of species, have been devised by MacArthur. One model corresponds essentially to the truth of the principle, the other to its negation. These models apply only to biological associations of organisms of about the same size, living in homogeneously diverse biotopes, in which the mean free paths of the organisms in questions are large compared to the elements of the environmental mosaic. Where the conditions required by the postulates of the models are satisfied, the observed results are in accordance with the model assuming the truth of the principle. (Auth. summ.)

2993. Povoledo, Domenico. 1959. STUDI CHIMICI SULLE SOSTANZE ORGANICHE AZOTATE SEDIMENTARIE E SESTONICHE DI ALCUNI LACHI DELLA ITALIA SETTENTRIONALE. Memorie Dell'Istituto Italiano di Idrobiologia, Vol. XI, pp. 25-60. (In Italian with English summary)

The results are given of a study of sediments from Lakes Varese, Mergozzo and Maggiore, in which the amounts of organic matter, of total organic nitrogen, and easily extractive amino nitrogen and that produced by hydrolysis, have been determined.

The methods of extraction and of hydrolysis of the sediments are described, and subsequently of salt

removal and chromatography by partition on paper and by displacement of ion exchange resins, by means of which the amino acids present in the extracts and hydrolisates were studied. Controls are described which brought to light certain limitations of methods, showing that the quantities of the recoveries are hardly reproducible and are in any case small; particularly marked are the losses of aspartic and glutamic acids, and, in the case of chromatography of ion exchange resins, those of hydroxyproline, β-alanine and argine.

The results obtained are briefly discussed, and it seems that in these lakes the chemical composition of the sedimentary organic matter reflects that of the seston present in the supernatant water. This organic matter of sediments could furnish, if utilizable, a qualitatively complete source of aliments for the benthonic flora and fauna, at least as regards amino acids; the absence of trytophan has not in fact been proved. It is to be presumed that in the process of mineralization of the seston the degradation of its proteic constituents is incomplete and associated with a profound rearrangement.

From a preliminary examination of the absolute concentrations of total and amino nitrogen, and the concentration relative to the organic substances, the conclusion of other authors is confirmed, according to which - omitting any allochtonous contribution - the process of eutrophysation of a lake is accompanied (or conditioned) by a greater availability of organic nitrogen in the sediments and one may propose, as a working hypothesis, that it is associated with a greater utilization of amino nitrogen, perhaps in the form of amino acids. (Auth. summ.)

2994. Stangenberg, Marian. 1959. DER BIOCHEMISCHE SAUERSTOFFBEDARF DES SEEWASSERS. Memorie Dell'Istituto Italiano di Idrobiologia, Vol. XI, pp. 185-211. (In German with English summary).

The actual oxygen uptake (BOD estimation) differs strongly in a lake water from the "theoretical" premises. The differences in biocoenotic composition and the levels of decomposition of the organic matter seem to be responsible for it. There is to distinguish especially between the upper epilimnion and the deeper layers of water. The most part of the organic matter (estimated by BOD) exerts in the epilimnion a remarkable oxygen uptake only when a biological (dissimilation and death) and a bacteriological (decomposition) elaboration has occurred. In a deep water the majority of the process takes place during the first days of BOD estimation, because the early stage of decomposition has been already performed in the upper layers of the lake.

The BOD_5-20°C of water from different lakes varied between 0, 4-8 mg/l 0_2 according to the type of the lake and the depth of sampling. The BOD of water from some unpolluted lakes sometimes reached the values of polluted waters. This shows that organic matter is accumulated in some dystrophic lakes and natural ponds in large amounts and can display effects of the same order as in contaminated waters. The analogous layers in lakes of different type show very often the same BOD. The BOD stratification varies in lakes of different types as strongly as 1:8, and is very evident in lakes of the eutrophic order. The BOD of metalimnic water did not prove the accumulation of organic matter which many authors supposed to exist there. An accumulation, on the contrary, has been found rather above and just below this layer.

It is quite clear from calculations that an oxygen stock stored in deep water during the early spring cannot cover its biochemical oxygen demand, as the only source of oxygen there should be supported by a supply of epilimnic water, i.e., through a water exchange between epi- and hypolimnion.

The study of BOD gives further information about the metabolism of the organic matter in lakes (level of mineralization) which cannot be ascribed to a particular type of a trophic basis. BOD values depend strongly on the biocoenotical charge of water. Every method of filtration (plankton-net Nr. 25, blotting-paper, laboratory filter, Berkefeld-filter) caused an increase on the BOD-figures. One must suppose that this effect was caused by mechanical stimulation, or separation of single bacterial cells from their colonies.

The addition of nutrients salts (PO_4, NO_3) usually increased the BOD values of the water, regardless of its position (depth) in the lake. The addition of nutrients, especially PO_4, to previously filtered water usually gave the highest values in comparison with unfiltered water. (Auth. summ.)

2995. Vollenweider, Richard A. 1959. AL CUNE OSSERVAZIONI SULLA DINAMICA FELL'OSSIGENO NEL LAGO MAGGIORE (BACINO DI PALLANZA). Memorie Dell'Istituto Italiano di Idrobiologia, Vol. XI, pp. 241-264. (In Italian with English summary)

A discussion concerning the oxygen metabolism in the uppermost strata of Lago Maggiore is presented, based upon a comparison on short term "in situ" changes of the oxygen content and studies of diurnal oxygen consumption rates "in vitro".

Average oxygen values, covering a period from May till December 1954, indicate the prevalent occurrence of maxima and minima at the 5 and 15 m depths respectively. Epilimnetic strata are supersaturated from May until November, whereas during the same period the subepilimnetic deficit increases progressively.

The mean daily oxygen decreases "in situ" are in good agreement with the experimentally determined oxygen consumption rated "in vitro", if allowance is made for the effects of eddy diffusion "in situ". Daily consumption estimates in the subepilimnetic strata are in the order of 0, 07_2 g/m^3; this gives daily areal rates of 3-4 g O_2/m^2 in the uppermost 60 m stratum.

An hypothesis concerning the prevalent types of oxygen consumption processes, stratified with depth, is presented. It is suggested that (a) in the euphotic zone the oxygen consumption is mostly related to carbohydrate metabolism in both, respiration and bacteriological destruction; (b) in deeper strata pro-

teolytic processes are more important.

A considerable discrepancy between the estimated daily consumption rates and the liberation of oxygen related to photosynthesis was found if the latter was measured by the Gaarder-Gran (light-dark-bottles)-method. Apart from oxygen consumption related to mineralization of human sewage, the deficiencies might be in connection with experimental interferences. Evidences suggest a possibly inhibited photosynthetic activity in the light bottles.

An attempt is made to classify the Lago Maggiore with regard to its "hypolimnetic areal deficit (Hutchinson)." Accordingly the Lago Maggiore might be considered as "weakly eutrophic." (Auth. summ.)

2996. Hubbs, Clark, and William F. Hettler, 1959. FLUCTUATIONS OF SOME CENTRAL TEXAS FISH POPULATIONS. The Southwestern Naturalist 3: 13-16.

The relative abundance of fishes at specific central Texas localities usually is more or less constant. Notable exceptions include: replacement of Gambusia geiseri by Notropis venustus and N. amabilis in the South Concho River; the disappearance of Hadropterus scierus in the Guadalupe River in Kerr County; and the drastic reduction in Etheostoma spectabile populations in the Colorado River in Austin and consequent increase of E. lepidum and E. chlorosomum populations. The variations are correlated with known changes in stream ecology. (Auth. abst.)

2997. Hubbs, Clark, and Lee Stavenhagen. 1958. EFFECTS OF MATERNAL CAROTENOID DEFICIENCY ON THE VIABILITY OF DARTER (OSTEICHTHYES) OFFSPRING. Physiological Zoology, Vol. XXXI, No. 4, pp. 280-283.

Female greenthroat darters fed a diet deficient in carotenoids and vitamin A produce eggs that have reduced survival. The same fish produce viable offspring when carotenoids are added to their previously deficient diet. Eggs from females fed supplemented diets have a higher initial mortality than do those from control females. (Auth. summ.)

2998. Hubbs, Clark. 1958. A CHECKLIST OF TEXAS FRESH-WATER FISHES. Division of Inland Fisheries, Texas Game and Fish Commission, IF Series - No. 3, Revised, 14 pgs.

This checklist is modified from that of Hubbs (1957a). A number of changes have been made in nomenclature. (Auth.)

2999. Wickett, W. Percy. 1959. OBSERVATIONS ON ADULT PINK SALMON BEHAVIOUR. Progress Reports of the Pacific Coast Stations, Fisheries Research Board of Canada, 113, pp. 6-7.

The behaviour of spawning adult pink salmon was recorded at Nile Creek, B. C., during the 1953 season. (Auth.)

3000. Wickett, W. Percy. 1959. NOTE ON THE BEHAVIOUR OF PINK SALMON FRY. Progress Reports of the Pacific Coast Stations, Fisheries Research Board of Canada, No. 113, pp. 8-9.

In the spring of 1954, pink salmon fry were observed as they swam in the surface film of the pool above the counting fence at the mouth of Nile Creek. Both upstream and downstream movements were seen under differing conditions. (Auth.)

3001. Bennett, E. B. 1959. SOME OCEANOGRAPHIC FEATURES OF THE NORTHEAST PACIFIC OCEAN DURING AUGUST 1955. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 5, pp. 565-633.

Physical oceanographic data from the international NorPac survey of August 1955, in the area north of Lat. 45°N and east of Long. 161°W were examined. The temperature, salinity, and density distribution and structure from the surface to 2000 m are discussed.

The temperature structure showed an isothermal layer to about 30 m depth, a marked thermocline to about 100 m depth, a temperature inversion in most of the area, and below this a gradual temperature decrease into the abyss. At all depths the water was coldest in a "cold core" centered about 100 miles south of Kodiak and the Shumagin Islands. From there the temperature increased at each level in all directions.

The salinity structure showed an isohaline layer to about 100 m depth, a marked halocline to about 200 m depth and below this the salinity increased slightly into the abyss. The salinity structure did not coincide with the temperature structure.

The density structure showed an isopycnal layer to about 30 m depth, a pycnocline associated with the thermocline, a second isopycnal layer, a second pycnocline associated with the halocline, and below this the density increased slightly into the abyss.

Variations in these structures throughout the region are discussed in some detail.

There is no horizontal isosteric level in the 2000 m of depth. It is concluded that there is no level of "no net motion" in this range, but a reference level of 2000 decibars (db) for dynamic calculations is more acceptable than the usual 1000-db level. A new procedure is introduced to extend the reference level into the bottom in near coastal areas.

The geostrophic currents were calculated. There was a major latitudinal drift from the west into the central part of the area. It veered northward and continued around the Gulf of Alaska, forming the Alaska Gyral, and left the area to the westward, as an intensified current (Alaskan Stream) close along the Alaskan Peninsula. This intensification is probably due to conservation of absolute vorticity through changing latitude.

The circulation pattern extended to at least 2000 m depth, and probably to the bottom. It transported about 17 million m^3 of water per second. There were a number of eddies in the system, some of which were observed on earlier surveys.

The major flow pattern was not wind-generated within the region. The influence of local winds was

limited to the upper 200 m of depth. In some areas it aided the flow, and in others retarded it.

There is evidence to show that two chains of seamounts influenced the current pattern according to Sverdrup concept. Since the major portion of these is below 2000 m depth it is concluded that currents exist in the abyss, in essentially the same direction as at the upper levels. (Auth. abst.)

3002. Pickard, G. L., and Keith Rodgers. 1959. CURRENT MEASUREMENTS IN KNIGHT INLET, BRITISH COLUMBIA. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 5, pp. 635-678.

One of the features of the circulation in an estuary is the net outflow in the surface layer of the fresh water discharged into the estuary together with an appreciable volume of salt water entrained. Continuity considerations require that there be an inflow of salt water to compensate for that taken out in the surface. In a shallow estuary, such as Chesapeake Bay, this results in a two layer flow, out at the surface and in below it.

In a deep estuary, the questions arise whether or not it also possesses this simple two-layer flow and what is the depth and extent of the inflow. Measurements have been made in several inlets in the British Columbia coast to obtain information about the circulation in a deep estuary. Preliminary experiments were made in Toba, Bute and Knight Inlets, the series made in Knight Inlet in July 1956 being the most complete. The techniques employed and the results obtained are described and discussed.

In a shallow section (75 m), in-and-out (flood-and-ebb) flow occurred in phase from surface to bottom, with a net outflow in the upper half and inflow below this. In the presence of an up-inlet wind, the flow in the surface few metres reversed and became up-inlet, with an increased outflow below it.

In a deep section, both oscillatory (tidal period) as well as net currents occurred at all depths from the surface to 300 m (relevant bottom depth was 350 m). In this deeper section, the oscillatory components were not in phase from surface to bottom, and the net flow showed a three- or four-layer pattern, rather than the simple two-layer pattern which has previously been assumed to exist. The wind had a marked direct effect on the upper layers to a depth of about 10 m and possibly deeper.

The movement of the ship while at anchor was monitored and found to be considerable. Most of the current observations were corrected for ship motion before analysis.

Calculations of the net fresh water transport (in the upper layer) give reasonable values but similar calculations for the deep water show a net transport which is not to be expected. This apparent net transport may be a consequence of assuming that the current profile across the entire inlet is the same as that in the centre where measurement were made. Other possible sources of error are suggested. In addition, several recommendations are made for future work. (Auth. abst.)

3003. Lindsey, C. C., T. G. Northcote, and G. F. Hartman. 1959. HOMING OF RAINBOW TROUT TO INLET AND OUTLET SPAWNING STREAMS AT LOON LAKE, BRITISH COLUMBIA. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 5, pp. 695-719.

A four year field study was conducted on rainbow trout (Salmo gairdneri) spawning in the inlet and outlet of Loon Lake. Young and adult trout were trapped and marked in both streams. About 5000 fish spawn in the outlet between mid-March and June; about 22,000 spawn in the inlet between late April and July. Outlet young either enter the lake by late summer or overwinter in the stream and enter the lake next spring or summer. Most inlet young enter the lake in their first year. Return as adults, of fish which had been clipped while entering the lake as young, indicated that about 94% of fish originating from each end homed to their parent stream. Because of the large number of inlet spawners, about a quarter of the outlet spawners are strays which had hatched in the inlet. Recovery of marked fish, movement of adults within the lake, and experimental transfer of adults and young between streams, all indicate that inlet and outlet spawners do not differ genetically in their responses to current. The biological and applied significance of homing, and its possible mechanisms, are discussed. (Auth. abst.)

3004. Parker, Robert R., and Peter A. Larkin 1959. A CONCEPT OF GROWTH IN FISHES. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 5, pp. 721-745.

The use of size as a basic determinant of growth rate is discussed and compared to analogous situations described in literature on other physiological rates. Ecological opportunity and physiological opportunity are visualized as the two interacting components that determine growth, both of which are entered at "threshold" sizes. The parabolic function,

$$dw/dt = kw^x$$

is developed into a growth equation for linear dimensions and its application explored and discussed using steelhead trout and chinook salmon as an example. Significant differences in growth rate are found between life history types and sexes. The chinook data are then treated on a l_{t+1}, l_t plot and it is shown how an apparent fit of the von Bertalanffy type growth equation can result from selectivity of fishing for the larger fish of any brood year. Two lines of research are indicated. (1) The independent measurement of the exponent x through study of size-specific metabolic rates, and (2) the relationship between total mortality rate and growth rate. Without this knowledge a satisfactory synthesis of growth rate into a yield equation cannot be achieved. (Auth. abst.)

3005. Krimholz, Louis A., and Gerald A. Cole. 1959. STUDIES ON A KENTUCKY KNOBS LAKE. IV. SOME LIMNOLOGICAL CONDITIONS DURING AN UNUSUALLY COLD WINTER. Limnology and

Oceanography, Vol. IV, No. 4, pp. 367-385.

Physical and chemical conditions in Tom Wallace Lake, Kentucky, were studied through three intermittent ice covers for a period of 49 days during January and February 1958.

A Birgean heat budget, based on temperatures observed from a station over the deepest part of the basin, involved a loss of 80 g-cal/cm^2 for the entire period. However, temperature profiles made from several stations revealed that there was considerable vertical and horizontal turbulence within the water mass beneath the ice, and that isotherms were not horizontal.

Although temperatures of the sediment and deep waters fluctuated, the direction of heat flow from the thin layer of profundal sediment was always upward into the overlying one or two meters of water. Most temperature changes at mid depths, especially at 5 m, were probably caused by lateral transport of heat, since vertical thermal gradients in the uppermost one or two meters beneath the ice was more varied. At times heat seemed to be moving downward from the ice; at other times an inverse gradient was observed even though the upper water was gaining heat.

On several days the vertical temperature profile could not be reconciled with the density of water as a function of the prevailing temperatures, and in a few instances these anomalous stratifications could not be correlated with available chemical data. Some relative-density determinations of water from different depths showed on one occasion that there was no instability in spite of an anomalous temperature profile.

Freezing-out effects during times of ice formation, and diluting caused by rain and melting were reflected beneath the ice in changing values of total alkalinity, total iron, and total solids.

Stratification and variation in values of dissolved oxygen, total alkalinity, iron, and total solids are discussed. (Auth. abst.)

3006. Pratt, David M. 1959. THE PHYTOPLANKTON OF NARRAGANSETT BAY. Limnology and Oceanography, Vol. IV, No. 4, pp. 425-440

The phytoplankton of Narragansett Bay is described on the basis of 927 unpreserved samples taken at a series of stations from 1952 to 1956. The annual cycle is divided into four natural periods: 1, (winter and spring) with diatoms dominant; 2, (usually late spring, early summer), flagellates dominant; 3, usually late summer) diatoms dominant; 4, (fall) flagellates dominant. The major features of this cycle, with maxima in the first and third seasons, are largely due to changes in the concentrations of diatoms, principally Skeletonema costatum. Although the concentrations of diatoms and of flagellates in any given season are predictable only within wide limits, their average abundance for the entire annual cycle is relatively constant. Average standing crops in the East and West Passages are approximately the same, but the Upper Bay is more than three times as rich as the lower in both diatoms and flagellates. The highly estuarine upper West Passage is characterized by certain neritic dinoflagellates, while the lower East Passage is marked by oceanic diatoms. Microflagellates and Skeletonema costatum are outstanding in frequency of occurrence and as dominants. Each of the four seasons is distinguished by certain dominant species. Correlations of the dominance of the most important species with prevailing temperatures reveal apparent temperature preferences, some species being eurythermal as dominants while other dominants are restricted to narrow temperature ranges. From the first to the third or fourth period there is a progressive increase in the number of species represented, the rate of change in species composition, and the spatial heterogeneity of the population. The average annual standing crop is more than two times as great as that in adjacent coastal waters. This difference is explained by the unusual length of the winter-spring diatom flowering in the Bay (January-May), which results from the combined effects of shallowness, moderate nontidal drift, and turbulence generated by tidal activity. The secondary diatom maximum in the Bay and in the coastal waters of southern New England is typically a summer event and usually precedes the major annual breakdown of stratification in the fall. (Auth. abst.)

3007. Henson, E. B. 1959. EVIDENCE OF INTERNAL WAVE ACTIVITY IN CAYUGA LAKE, NEW YORK. Limnology and Oceanography, Vol. 4, No. 4, pp. 441-447.

Temperature observations from a station near the southern end of Cayuga Lake, New York, reveal variations in the depths of the isotherms which suggest the presence of temperature seiches, or internal waves. The theoretical period of oscillation of a uninodal internal wave, based on summer temperature conditions of the lake, ranges between 55 and 58 hours. A sequence of temperature observations at the level of the metalimnion for the first eight days of August, 1951, are presented, and the observed variations are in accord with the theoretical variations. The winds during the time under consideration were reinforcing and occurred in synchrony with the seiche movements, producing an amplitude in excess of 20 meters which is about twice the normal amplitude. Observations of surface currents and temperatures give supporting evidence for the presence of internal wave activity. (Auth. abst.)

3008. Huet, Marcel. 1959. PROFILES AND BIOLOGY OF WESTERN EUROPEAN STREAMS AS RELATED TO FISH MANAGEMENT. Transactions of the American Fisheries Society, Vol. 88, No. 3, pp. 155-163.

In the running waters of temperate Western Europe there are four main biological zones, each of which is characterized by a distinctive fish fauna. These are designated; (1) trout, (2) grayling, (3) barbel, and (4) bream zones. They are related basically to longitudinal section (slope of the stream bed) and to the cross section of the stream and its

valley.. The physical and biological characteristics of these zones are discussed together with the concepts "slope-rule" and "slope-graph", which express these relationships, and which have proven useful for evaluating and comparing running waters and for estimating fisheries potentials of streams from topographic information. (Auth. abst.)

3009. McFadden, James T. 1959. RELATIONSHIP OF SIZE AND AGE TO TIME OF ANNULUS FORMATION IN BROOK TROUT. Transactions of the American Fisheries Society, Vol. 88, No. 3, pp. 176-177.

Scale samples were taken from brook trout in Lawrence Creek, Wisconsin on April 12, 13, and 16, 1956. During this period some of the fish had formed identifiable annuli for the current year and others had not. It was found that a larger proportion of the younger fish (I's and II's) had identifiable annuli than fish of Age Group III. Among fish of the same age, more of the larger ones had completed the current annulus. (Auth. abst.)

3010. Moyle, John B., and William D. Clothier, 1959. EFFECTS OF MANAGEMENT AND WINTER OXYGEN LEVELS ON THE FISH POPULATION OF A PRAIRIE LAKE. Transactions of the American Fisheries Society, Vol. 88, No. 3, pp. 178-185.

Take of carp by annual intensive winter seining from Lake Traverse, a shallow 11,000-acre lake, declined from 58,000 to 500 pounds per seine haul during the period 1951-1958. Concurrently, the catch of crappies, which were returned to the lake, rose from 2 to 84 thousand fish per haul. Bullheads were also removed, mostly by hoopnets, in amounts ranging from 7 to 56 pounds per acre per year with greatest removal in 1956-57. Average catch per hoopnet pocket was 25.3 pounds in 1950-55 and 65 pounds in 1956-58.

Walleyes, mostly as fry, were stocked in all 13 years of the 1945-1958 period considered and northern pike and rescued black crappies in some of these years. It appears from consideration of winter oxygen levels and subsequent take of game fish in seines that walleyes (and probably channel catfish and bluegills) did not survive as well at winter oxygen levels below 5 p.p.m. as above this level. Northern pike, crappies and rough fish were more tolerant and evidently survived well when oxygen levels fell to near 1 p.p.m. (Auth. abst.)

3011. Ruggles, C. P. 1959. SALMON POPULATIONS AND BOTTOM FAUNA IN THE WENATCHEE RIVER, WASHINGTON. Transactions of the American Fisheries Society, Vol. 88, No. 3, pp. 186-190.

The standing crop of bottom fauna in the Wenatchee River, Washington, and its tributary Nason Creek, declined from an average of 233 animals per square foot in the fall of 1940, to an average of 50 animals per square foot in the falls of 1955 and 1956. Average volumes declined from 2.7 cubic centimeters per square foot in 1940 to 0.3 and 0.4 cubic centimeters per square foot in 1955 and 1956. During this same interval the populations of chinook salmon and steelhead trout in the stream had increased greatly and the sockeye run had increased at least sevenfold. Since sockeye young migrate down the Wenatchee River after spending their juvenile period in Lake Wenatchee, it seems likely that the increase in salmonids in the stream has been an important factor in reducing the bottom fauna crop. (Auth. abst.)

3012. Havey, Keith A. 1959. VALIDITY OF THE SCALE METHOD FOR AGING HATCHERY-REARED ATLANTIC SALMON. Transactions of the American Fisheries Society, Vol. 88, No. 3, pp. 193-196.

Scale samples from 142 hatchery-reared lake Atlantic salmon, Salmo salar, of known age were studied to determine degree of correlation between known age and age as determined by scale interpretation. Salmon sampled had been marked by finclips before stocking and had been at large for one to five years. They were survivors of three successive stockings of 16-month-old (from hatching), fall-stocked fish. All scales were taken from angled salmon checked during a continuing creel census at Long Pond, Hancock County, Maine.

Approximately 80 percent of the 142 fish could be correctly aged by employing usual criteria for annulus location. Winter band counts were the best single criterion for aging after Age I. All ages could be determined within one year.

The patterns of scale growth that occurred under hatchery conditions were usually more irregular than patterns formed under lake conditions. These irregularities led to most errors in age determination. Scale absorption associated with reproduction was not a source of error in aging. However, only ten scales showed spawning marks, and no scales were examined that indicated more than one spawning. Slow growing fish were as readily aged as rapidly growing individuals. (Auth. abst.)

3013. Jeppson, Paul W., and William S. Platts. 1959. ECOLOGY AND CONTROL OF THE COLUMBIA SQUAWFISH IN NORTHERN IDAHO LAKES. Transactions of the American Fisheries Society, Vol. 88, No. 3, pp. 197-202.

Columbia squawfish, Ptychocheilus oregonensis, and trout were found to occupy similar niches, resulting in competition for food and space, and predation on each other. Mature squawfish are piscivorous with food habits similar to Dolly Varden, Salvelinus malma, rainbow trout, Salmo gairdneri, and brown bullhead, Ictalurus nebulosus. Age and growth data are presented and in northern Idaho lakes a 13-year-old female squawfish attains a maximum weight of approximately 9 pounds. Males grow slower, averaging less than one half the size of the females. Spawning by lake populations accurs in lakes and streams. Lake spawning is in schools during late May and early June over wave-washed rubble on clear, calm days. The number of eggs in mature females varies from 12,000 to 100,000, averaging 40,000. Eggs hatch in 7 to 8 days. In six years of squawfish control in 3,800-acre Hayden Lake by dynamiting and gill netting spawning schools, mature squawfish were reduced

to about one-tenth of their original abundance and an increase in trout noted. (Auth. abst.)

3014. Atton, F. M. 1959. THE INVASION OF MANITOBA AND SASKATCHEWAN BY CARP. Transactions of the American Fisheries Society, Vol. 88, No. 3, pp. 203-205.

The history of carp introductions and establishment in the Nelson River drainage is reviewed. Present distribution (1957) and possible points of invasion are shown. The rate of movement is examined and the importance of infertile and cold water as an ecological barrier is suggested. (Auth. abst.)

3015. Stevenson, James, and Andrew H. Hulsey. 1959. APPRAISAL AND MANAGEMENT RECOMMENDATIONS RESULTING FROM A THREE-YEAR COMPARATIVE FISHERY STUDY OF LAKE CATHERINE, LAKE HAMILTON, AND LAKE OUACHITA, ARKANSAS. Proceedings of the Twelfth Annual Conference, Southwestern Association of Game and Fish Commissioners, Oct. 19-22, 1958, Louisville, Kentucky, pp. 183-198.

A pattern of high original reservoir productivity followed by gradual decline (in terms of angling success and desirable fish production) has been evidenced in a chain of lakes, of different ages, on the Ouachita River, Arkansas. Lake Catherine, formed in 1923, consists of 3,000 acres; Lake Hamilton, created in 1931, consists of 7,200 acres, and Lake Ouachita, impounded in 1953, covers 40,000 acres. A comprehensive fishery study was conducted during the summers of 1955, 1956 and 1957 to investigate and compare the fishery resources of these lakes and formulate management plans.

Comparison of limnological data indicated that the physical-chemical factors of the water of the three lakes were normal and, in fact, appeared to be optimum for good fish production. Fertility, as determined by plankton collections and bottom fauna studies, was greater in Lake Catherine and Lake Hamilton than in Lake Ouachita. Fish population sampling, with seines, nets and rotenone, revealed that the standing crop of fishes in the older lakes, measured in pounds per acre, exceeded the crop in Lake Ouachita. The ratio of gizzard shad[1] and freshwater drum to game fish was considerably higher in the older lakes. The unbalanced and denser fish populations were reflected in slow growing sport fishes of smaller average size and lower fisherman success.

Management recommendations deal primarily with Lake Catherine and Lake Hamilton since fishing success remains relatively high on Lake Ouachita. Shad and drum removals, with rotenone, are proposed on Lakes Catherine and Hamilton, followed by a heavy stocking of yearling and fingerling predator game fish from the state hatcheries. It is recommended that smallmouth black bass and yellow pikeperch (walleye pike) be stocked to supplement formerly substantial populations; also an experimental stocking of rainbow trout be made in headwaters of Lake Hamilton (tailwater of Blakely Mountain Dam). A maximum harvest of all fishes in all lakes, including the legalized use of gill and trammel nets for commercial fish, is encouraged. Fall and winter drawdowns are recommended to aid in maintaining balanced populations. Water levels should be held steady from May 1st to June 1st each year.

Several of the management recommendations have already been carried to completion, and it is believed all will eventually be applied to these lakes, resulting in improved fishing success. (Auth. abst.)

3016. Lambou, Victor W., and Herbert Stern, Jr. 1959. PRELIMINARY REPORT ON THE EFFECTS OF THE REMOVAL OF ROUGH FISHES ON THE CLEAR LAKE SPORT FISHERY. Proceedings of the Twelfth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 19-22, 1958, pp. 36-56.

This report is concerned primarily in changes occurring in sport fishing over a five-year period following removal of rough fishes by seining.

3017. Montgomery, Alex B., and Howard D. Zeller. 1959. THE EVALUATION OF CHEMICAL AQUATIC WEED CONTROL IN GEORGIA FARM PONDS. Proceedings of the Twelfth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 19-22, 1958, pp. 56-63.

Aquatic weed control has in recent years developed into one of the most important phases of farm pond management in Georgia.

Properly constructed ponds with adequate fertilization which were chemically treated four years ago show no reinfestation at this time. On the other hand, in experimental ponds which were not properly fertilized the results of chemical weed control were of extremely short duration.

The more frequently used herbicides, Sodium arsenite, D, 4-D (ester and amines), 2, 4-D-2, 4, 5-T combinations, and Copper sulphate are considered with regard to methods of application, cost of treatments, effectiveness on different plant species and duration of successful weed elimination.

Sodium arsenite was found universally effective in the control of most submerged aquatic plant species. However, its toxicity to warm blooded animals and the caution necessary in its application and handling restrict its use to experienced technicians. Careless handling of this material in Georgia has resulted in injury to personnel as well as the loss of livestock in one instance. Growth regulating 2, 4-D and 2, 4, 5-T compounds were effective in the control of most broad leafed emergent aquatics. The use of both oil and water carriers was evaluated. To achieve complete control, more than one application was usually required. Copper sulphate was found to be the most economical and effective algicide.

Some of the newer aquatic herbicides, Dowpon, Pelletized 2, 4-D, Kuron, Novon and Delrad are discussed in relation to their effectiveness. Particular emphasis was placed on the control of Manna grass (Glyceria sp.) with these chemicals. Those showing promise are further evaluated as to effectiveness of

a large variety of plants.

Dowpon appeared very promising in the control of aquatic grasses. Pelletized 2, 4-D and Kuron, formulated for use on submerged aquatic species, gave excellent preliminary results. Cost of treatment per acre with these materials is somewhat higher than with sodium arsenite, however, certain advantages offered by these chemicals may offset increase in cost. Delrad was found to be effective in the control of most species of filamentous algae. The use of this material in Georgia was virtually prohibited because of rapid reinfestation following treatment, poor availability, and a high per acre cost of treatment.

Aquatic herbicides were found to be an effective and economical means of eradicating most aquatic nuisances. The advantages and disadvantages of most materials are discussed and the newer herbicides are considered with regard to their use in future aquatic weed control work. (Auth. abst.)

3018. Davis, James T., and Lloyd E. Posey, Jr. 1959. LENGTH AT MATURITY OF CHANNEL CATFISH (ICTALURUS LACUSTRIS) IN LOUISIANA. Proceedings of the Twelfth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 19-22, 1958, pp. 72-74.

The majority of females examined were mature at 10.5 thru 12.5 inches. However, considerable overlap in length existed between immature and mature fish of both sexes. The smallest mature female was seven inches and the largest immature female was 15.5 inches. The smallest mature male was 8.5 inches and the largest immature male was 17.0 inches. (Auth. abst.)

3019. Nelson, Ben A. 1959. PROGRESS REPORT ON GOLDEN CHANNEL CATFISH. Proceedings of the Twelfth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 19-22, 1958, pp. 75-78.

In June, 1956, albino channel catfish (Ictalurus lacustris) were observed to occur in possibly two spawns from wild colored parents. These albino channel catfish have been named "Golden Channel Catfish." By stocking the golden channel catfish fingerlings in large water areas, sufficient growth was obtained so that several of the fish became sexually mature at the age of two years and a weight of about two pounds. Three spawns were obtained from these two-year-old golden channel catfish in the spring of 1958, and all the young were golden (albino) in color.

The golden channel catfish seems to be equal in ruggedness to the wild colored individuals and possesses superior eye appeal both alive and dressed. The strain of fish evolved has a domesticated history exceeding ten years. (Auth. abst.)

3020. Martin, Mayo. 1959. WALLEYE HATCHING, REARING AND TRANSPORTING TECHNIQUES AS PRACTICED IN KENTUCKY. Proceedings of the Twelfth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 19-22, 1958, pp. 78-91.

This study revealed that walleye, Stizostedic vitreum vitreum (Mitchell), can be jar-hatched, stocked, and a portion raised to fingerling size, for an annual outlay of $1,000.00 or less.

Early returns indicate that walleye can be expensively established by stocking fry in either old or new lakes. The method used was to stock the fish in intermittent rows from a boat. Both open-water stocking and shoreline stocking were practiced successfully.

Two ponds were utilized for experimental walleye production in 1958. Walleye were produced at the rate of 21,255 fingerling walleye 1 1/2 to 2 inches in length per acre in one experimental pond and 10,333 in another pond, without resorting to feeding with minnows. This seemed to indicate that walleye lend themselves to pond culture as far south as Kentucky. The experimental evidence concurred with the findings of Dobie (1956) in Minnesota and indicated that production was augmented by the use of organic fertilizers. The writer used hay and soybean meal. It was felt that hay was especially beneficial by helping to prevent phytoplankton blooms.

Both fry and fingerlings were hauled in station wagons in plastic bags placed in cardboard beer cases, a variation of the Ohio method.

The fry were hauled at an average of 36,000 per bag, 12 to 20 bags per station wagon. Various containers were used to carry the bags, and beer cases were found to be particularly tough and re-usable. They could be stacked 2 or 3 high and provided excellent insulation.

O-Tabs, made by Pemble Laboratories, were more successful than bottled oxygen for hauling fry. Buffers, such as dibasic sodium phosphate and sodium bicarbonate, were tried experimentally but were found to be unnecessary. Icing was also used experimentally and was successful but unnecessary.

Preliminary evidence indicated that fingerling walleye 1 1/2 to 2 inches in length and weighing 728 per pound could probably be hauled at the rate of 7,000 to 9,000 per station wagon load. Buffers were needed for hauling fingerlings in plastic bags. Best results were obtained by using dibasic sodium phosphate, activated charcoal, and icing the bag. (Auth. abst.)

3021. Hall, John F. 1959. FINAL REPORT ON THE SUCCESS OR LARGEMOUTH BASS-BLUEGILL AND LARGEMOUTH BASS-SHELLCRACKER RATES AND RATIOS IN KENTUCKY FARM PONDS. Proceedings of the Twelfth Annual Conference of the Southeastern Association of Game and Fish Commissioners, October 19-22, 1958, Louisville, Kentucky, pp. 91-116.

In order to test the relative success of various stocking rates of largemouth bass, Micropterus salmoides (Lacepede)-bluegill, Lepomis macrochirus Rafinesque, combinations and largemouth bass-shellcracker, Lepomis microlophus (Gunther), in farm ponds in Kentucky, 574 ponds were stocked with these fishes in the following combinations and rates: fry bass: fingerling bluegill 30:400, 50:500, 80:500 and

100:500 per acre; fry bass:adult bluegill 100:30, 100:50 and 100:70 per acre; fry bass:fingerling shellcracker 500:300 and 50:600 per acre; fry bass: fingerling shellcracker + mosquito fish, Gambusia affinis (Baird and Girard), 50:300 + 400 and 50:600 + 400 per acre.

In each year from 1952 through 1956, a series of ponds was stocked. No pond was stocked more than once nor with more than one rate. Bass-bluegill combinations were stocked in each of the first four years, the shellcracker combinations in 1953, 1955, and 1956.

Each pond was investigated annually and the success of each rate was determined by the percentage of balanced ponds that the rate produced.

No significant differences in percentage of success were found among the following bass-bluegill rates: 80:500, 100:500 (fry bass:fingerling bluegill), 100:30, 100:50, and 100:70 (fry bass:adult bluegill).

The most successful bass-shellcracker rate could not be determined because of the large number of ponds that failed to produce reliable data.

A total of 384 or 66.9% of the ponds stocked failed to yield reliable data and were discontinued during the investigation. The invasion of the ponds by other fish was the principal reason that these ponds were discontinued. (Auth. abst.)

3022. Chance, Charles J. 1959. HISTORY OF FISH AND FISHING IN NORRIS, A TVA TRIBUTARY RESERVOIR. Proceedings of the Twelfth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 19-22, 1958, Louisville, Kentucky, pp. 116-127.

Norris Reservoir, the first TVA tributary reservoir, completed in 1936, has a spillway surface area of 34,200 acres. Earliest fish inventory records in the basin indicate 17 indigenous families of fishes represented by 40 genera and 65 species. Four families, Petromyzonidae, Anguillidae, Cyprinodontidae, and Cottidae, were able to cope with the reservoir environment. Several genera and species of Cyprinidae and Percidae likewise did not survive. Game and commercial species generally have prospered in the reservoir.

A 14-year creel census on Norris shows considerable annual variation in catch but no trend to support the historical idea that reservoirs become "biological deserts."

Harvesting or fishing mortality studies over a 14-year period show an average tag return ratio of 17.2 percent. Year to year variation from the mean indicates that the obvious increase in fishing pressure since 1950 has not increased the relative rate of harvest. Variation in harvest rate by species is also shown. The Norris data show that the offer of prizes has little influence on tag returns.

Redistribution of species within a reservoir is also indicated by tag returns. Sauger and walleye in Norris travelled 0-150 miles, black basses and crappie 0 to 35 miles. (Auth. abst.)

3023. Hulsey, Andrew H. 1959. A PROPOSAL FOR THE MANAGEMENT OF RESERVOIRS FOR FISHERIES. Proceedings of the Twelfth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 19-22, 1958, Louisville, Kentucky, pp. 132-143.

A fisheries management plan for reservoirs is proposed which is dependent upon having a fish management pool and provision for drainage incorporated into the basic design. Justification is given to support the cost of having a cleared management pool in the bottom of the reservoir as well as drainage facilities. A plan is also proposed for selective clearing of reservoir basins.

The management program described is based on a philosophy of drastic manipulations of fish populations through fall and winter drawdowns, selective kills, partial kills, intensive sport and commercial fishing and other management practices designed to favor the carnivorous fishes and reduce the total number and pounds of all fish so as to bring about a balance of the predator fishes with their food supply and maintain expanding fish populations.

The drawdown is of paramount importance in the reservoir management scheme and, in the humid southeastern United States, it should begin immediately after Labor Day. The water level should be lowered to the fish management pool by October 15th or November 1st. According to the size of the watershed, water levels can be allowed to return to normal after January 1st. Cost of carrying out the management techniques in the fish management pool are minimal and most effective. (Auth. abst.)

3024. Smith, William A., Jr. 1959. SHAD MANAGEMENT IN RESERVOIRS. Proceedings of the Twelfth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 19-22, 1958, Louisville, Kentucky, pp. 143-147.

Management of some form is mandatory for the continuance or restoration of successful fishing in the majority of reservoirs in the Southern States. The selective killing of gizzard shad and some species of rough fish with rotenone shows promise as a management tool for some reservoirs. The use of rotenone as a selective toxicant in four Kentucky reservoirs is discussed. The total poundage of gizzard shad was drastically reduced in three reservoirs and this species was eliminated from a fourth reservoir. A definite improvement in fishing success was noted as a result of this chemical reduction of shad, buffalo, and carp. Also, an increase was in the spawning success and apparently better survival of bass occurred following the selective kill. (Auth. abst.)

3025. Hall, Gordon E., and Lawrence A. Farrer. 1959. RESERVOIR OPERATION FOR STATUTORY PURPOSES. Proceedings of the Twelfth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 19-22, 1958, Louisville, Kentucky, pp. 147-155.

The Corps of Engineers of the Department of the Army plans and constructs authorized flood control and multiple-purpose reservoirs under the general provisions of the Flood Control Acts of 1936 and 1944

and other legislation authorizing specific reservoir projects. The 1944 Act delegates to the Secretary of the Army responsibility for prescribing regulations for the use of flood control or navigation storage at all reservoirs, except those of the TVA, constructed wholly or in part with Federal funds.

Effective functional operation of reservoirs is a most important factor in insuring that they accomplish the purposes for which they were designed and produce the benefits which justified their construction. Flood control, navigation, and power development, singly or in combination, are the major purposes for which reservoir projects have usually been authorized in southeastern United States. Where uses of reservoir sites for agriculture, forestry, fish and wildlife conservation, and recreation were not inconsistent with the project operation for its authorized purposes, they were developed as an active part of the project.

The management of the fishery resource of a Federal reservoir is recognized as the responsibility of the state(s) in which the project is located. The Corps of Engineers cooperates with states to the extent possible in operating water levels for fishery benefits. Water-level management on reservoirs operated primarily for flood control is generally compatible with fish-management programs. Regulation schedules on multiple-purpose reservoirs are not subject to drastic changes for fishery purposes, but minor seasonal modifications are sometimes possible. Abnormal water levels during floods or droughts offer other opportunities for executing desirable fish management practices. Fishery personnel are urged to consider fully in their management plans the physical, operational, and economical limitations of individual reservoirs. (From auth. abst.)

3026. Stevens, Robert E. 1959. THE BLACK AND WHITE CRAPPIES OF THE SANTEE-COOPER RESERVOIR. Proceedings of the Twelfth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 19-22, 1958, Louisville, Kentucky, pp. 158-168.

The reservoir has a surface acreage of 160, 500 and contains two rather dissimilar lakes; namely, Lake Moultrie and Lake Marion.

A four-year continuous creel census indicated that three-fourths of the catch of crappies was made in Lake Marion.

Four distinct growth rates were encountered in a growth study of each species in each lake.

A food habit study of 149 full crappie stomachs showed insects to occur 77. 1% of the time and fish 55. 7% of the time.

A world record black crappie (Pomoxis nigromaculatus) was caught in Lake Moultrie on March 15, 1957. (Auth. abst.)

3027. Prather, E. E. 1959. FURTHER EXPERIMENTS ON FEEDS FOR FATHEAD MINNOWS. Proceedings of the Twelfth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 19-22, 1958, Louisville, Kentucky, pp. 176-178.

Fathead minnows averaging 1. 74 pounds per thousand were stocked into ponds January 21 at rates of 100, 000 per acre, and fed 6 days a week until the ponds were drained April 1. The feeds were three forms of Auburn No. 2 fish feed, namely, dry mix, crumbles, 3/8-inch diameter pellets, and a commercial trout pellet. The ingredients of the Auburn No. 2 fish feed were:

35% Soybean Oil Meal	(44% protein)
35% Ground Peanut Cake	(53% protein)
15% Fish Meal	(60% protein)
15% Distillers Dried Solubles	(24% protein)

The composition of the Auburn No. 2 fish feed was 46 percent protein, 26 percent carbohydrate, and 5 percent fat. The analysis of the trout ration was 43 percent protein, 20 percent nitrogen-free extract, 3. 25 percent fat, and 4 percent fiber.

The initial daily feeding rate was 3 percent of the body weight of the fish for the period January 22 to March 2. Twice the initial weight of feed was used from March 3 until March 31. No fertilizers were used during these experiments.

The gains in weights of fish from all ponds fed the Auburn No. 2 feeds were significantly greater than the average gain in weight of fish fed the commercial trout ration. There were no significant differences in gains among the fish fed the three forms of Auburn No. 2 feed, nor in survival among the four treatments. (Auth. abst.)

3028. Huish, Melvin T. 1959. A SUMMARY OF METHODS USED DURING FLORIDA'S GIZZARD SHAD CONTROL EXPERIMENTS. Proceedings of the Twelfth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 19-22, 1958, Louisville, Kentucky, pp. 178-183.

Determination of a desirable concentration of 5 percent emulsified rotenone in a given lake to control gizzard shad was accomplished by an observational technique. The concentration employed varied from 0. 06 p. p. m. to 0. 14 p. p. m. The time of year considered best suited for treatment was during the fall. Methods used to apply the toxicant were varied but appeared about equal of results except while using spray planes. The most favorable results occurred when good distribution was secured by using six to twelve hours for application, numerous surface units and dilute mixtures. As many as 4, 600 acre feet were treated by one efficiently equipped boat. A table is presented which was used as a basis for calculation of concentrations. At least three successive treatments one year apart were needed for the most effective control of shad. Conclusions regarding stocking were not drawn. (Auth. abst.)

3029. Copeland, J. B., and J. W. Woods. 1959. PRELIMINARY RESULTS OF SEVERAL HERBICIDES ON AQUATIC VEGETATION IN FLORIDA. Proceedings of the Twelfth Annual Conference, Southeastern Association of Game and Fish Commissioners, Oct. 19-22, 1958, Louisville, Kentucky, pp. 199-205.

The 1957 Legislature expanded the Florida Hyacinth Control Program to a Noxious Vegetation

Control Program. This made testing of herbicides for the control of other noxious plants necessary. A convenient field test of herbicides was developed. These herbicides were tested using diesel oil and/or water as a carrier.

The herbicides tested were Atlas "A" (sodium arsenite), Amino Triazole (3 amino-1, 2, 4, -triazol), Aquaherb (orthodichlobezene and aromatic salt), Aqua San (trichlorobenzene and aromatic petroleum distillate), Ammate (ammonium sulfomate), Atlacide-2, 4-D (sodium chlorate-2, 3-dichoroxyacetic acid), Granulated Chlorea (sodium chlorate, sodium metaborate and 3-(P-chlorophenyl)-1, 1-dimethylurea), Dowpon or Radapon sodium salt of 2, 2 dichloropropionic acid), Esteron (2, 4, 5-trichlorophenoxy-acetic acid, propylene gycol buytol ether ester), HCA (hexachloroacetone), Kuron, propylene butyl ether ester of 2(2-4, 5 trichlorophenoxy) propionic acid, M-502 (invert immulsion butoxy ethanol, ester of 2, 4-D), Simazine-10G (2-chloro-4, 6-bis-(ethylamino)-S-triazine), TCA (sodium salt of trichloroacetate), Veon-100 (dimethylamine salt of 2-4 dichlorophenoxyacetic acid-dimethylamine salt-2, 4, 5-trichlorophenoxyacetic acid), 2, 4-D Pellets (iso-octylhexyl) (ester 2, 4-D attaclay granules), 2, 4-5T Pellets (iso-octyl ester).

Several herbicides were used on separate plots of alligator weed, cattails, maiden cane, Najas, pickerel weed, spatterdock and water lettuce.

Preliminary results of these tests indicate an aquaherb and 2, 4-D combination, 2, 4-5T pellets or M-502 gave some control when used on alligator weed. Kuron, 2, 4-D Ester or HCA gave good results on pickerel weed. Dowpon, Radapon or 2, 4-D Ester gave excellent results on cattails. M-502 gave excellent results on water lettuce. None of the herbicides used on Najas or maiden cane gave the desired results, although Dowpon, Radapon and Amino Triazole showed some promise of control on maiden cane. Kuron gave a good indication of control of spatterdock. (Auth. abst,)

3030. Rounsefell, George A., and Bernard E. Skud. 1959. GALVESTON BIOLOGICAL LABORATORY, FISHERY RESEARCH. Circular 62, 127 pgs., Fish and Wildlife Service.

This is an annual report of the laboratory for the year ending June 30, 1959, covering its shrimp fishery, estuarine ecology, industrial fishery, and red tide investigations, plus several special reports and an hydrological study of the Mississippi River-Gulf Outlet Project, Louisiana.

3031. Leitritz, Earl. 1959. TROUT AND SALMON CULTURE (HATCHERY METHODS). Fish Bulletin No. 107, State of California, Department of Fish and Game, 169 pages.

This bulletin comprehensively covers hatchery requirements and fish culture techniques from spawning, egg measuring and picking, and incubators, through nutrition, to diseases and their treatment. It is designed as a reference to assist the average hatcheryman in his everyday problems.

3032. Hallock, Richard J., and William F. Van Woert. 1959. A SURVEY OF ANADROMOUS FISH LOSSES IN IRRIGATION DIVERSIONS FROM THE SACRAMENTO AND SAN JOAQUIN RIVERS. California Fish and Game, Vol. 45, No. 4, pp. 227-296.

The numbers of juvenile salmon and steelhead destroyed at individual diversions along the Sacramento River were quite small due to the fact that most of the fish migrate out of the upper river before the start of the main irrigation season. Considerable losses of adult salmon and steelhead, however, do occur at unscreened pump intakes.

Diversions along the San Joaquin were found to be destroying large numbers of fingerling salmon, due to the coincidence of the irrigation season and the salmon migration and the large proportion of river flows diverted.

All diversions sampled in the Sacramento-San Joaquin River Delta area were found to be taking fingerling salmon.

Studies of Butte Creek diversions showed that the migration period was over before the irrigation season began in both 1956 and 1957 but this was contrary to findings of 1955.

3033. Chadwick, Harold K. 1959. CALIFORNIA STURGEON TAGGING STUDIES. California Fish and Game, Vol. 45, No. 4, pp. 297-301.

Totals of 994 white sturgeon (Acipenser transmontanus) and 25 green sturgeon (A. medirostris) were tagged in San Pablo Bay during the fall of 1954 to gather information on angler harvest rates and migrations. The first year tag returns indicated that a minimum of 2% of the white sturgeon population was caught by anglers. One of the white sturgeon and three of the green sturgeon were recaptured in Oregon showing that there is some interchange among the Pacific Coast sturgeon populations. (Auth. abst.)

3034. Abramson, Norman, and Joyce Tolladay. 1959. THE USE OF PROBABILITY SAMPLING FOR ESTIMATING ANNUAL NUMBER OF ANGLER DAYS. California Fish and Game, Vol. 45, No. 4, pp. 303-311.

The advantages of probability sampling over non-probability sampling are discussed. Simple random sampling, stratified random sampling with proportional allocation, and stratified random sampling with optimum allocation are considered as methods for estimating the annual number of angler days expended.

Sample sizes for estimating total angler days with a 95 percent confidence interval having a half-width equal to 15 percent of the total were determined for each of the three sampling methods.

The required sample sizes for simple random sampling, proportional allocation, and optimum allocation were 100.9, 54.0, and 39.1, respectively.

The 1956 optimum allocation plan when applied to the 1957 angler count data was found suitable for estimating the number of angler days. (Auth. summ.)

3035. St. Amant, J. A. 1959. STRIPED BASS INTRODUCED INTO THE COLORADO RIVER. California Fish and Game, Vol. 45, No. 4, p. 353.

An experimental introduction of juvenile striped bass (Roccus saxatilis) was made in the lower Colorado River on April 15, 1959, in an attempt to establish an inland population of this species. A brief description of the transportation technique used during the trip from the San Joaquin River is included. (Auth.)

3036. Ahlstrom, Elbert H. 1959. VERTICAL DISTRIBUTION OF PELAGIC FISH EGGS AND LARVAE OFF CALIFORNIA AND BAJA CALIFORNIA. Fishery Bulletin 161 from Fishery Bulletin of the Fish and Wildlife Service, Vol. 60, pp. 107-146.

Information is given on the vertical distribution of 46 kinds of fish larvae and eight kinds of fish eggs, as determined from 22 series of hauls made at 15 stations off southern California and central Baja California. Each series consisted of 6 to 11 hauls taken with a closing net at successively deeper levels.

Most fish eggs and larvae were found to occur in the upper mixed layer and in the upper part of the thermocline between the surface and approximately 125 meters deep. All of the more common kinds of larvae showed marked differences in vertical distribution from series to series.

Replicate vertical distribution series were taken at seven stations, one in daylight, the other during darkness. Larvae of sardine anchovy, and Leuroglossus stilbius were four to five times as abundant in night series as in day. The night-to-day ratio for all larvae was 2 to 3.

Supplementary information on vertical distribution of larvae was obtained on Norpac, where two levels (131-0 meters and 262-131 meters) were fished at most stations. (Auth. abst.)

3037. Thompson, Richard B. 1959. FOOD OF THE SQUAWFISH PTYCHOCHEILUS OREGONENSIS (RICHARDSON) OF THE LOWER COLUMBIA RIVER. Fishery Bulletin 158 from Fishery Bulletin of the Fish and Wildlife Service, Vol. 60, pp. 43-58.

A study is presented of 3,546 stomachs of the squawfish, Ptychocheilus oregonensis (Richardson), collected from April 1955 to April 1956 in the lower Columbia River. The basic food table of the squawfish, based on a modified point system with emphasis on salmon predation is presented. Sixty-three percent of the stomachs examined were empty. Size of squawfish, season of the year, and geographical distribution within the river affect the occurrence and importance of the food items.

Major food items were fishes, crayfish, and insects, and, in much lesser amounts, plant materials, mollusks, and miscellaneous items. Squawfish from 3 to 8 inches long subsisted on a diet of insects; above that length fishes and crayfishes attained importance. At 11 inches, fishes and crayfishes were dominant and insects were only five percent of the stomach content.

All occurrences of juvenile salmon in squawfish stomachs were related to releases of young salmon from hatcheries. The role of the squawfish as a predator on salmon was limited to time and place where juvenile salmon concentrations were high following release. (Auth. abst.)

3038. Grosslein, Marvin D., and Lloyd L. Smith, Jr. 1959. THE GOLDEYE, AMPHIODON ALOSOIDES (RAFINESQUE), IN THE COMMERCIAL FISHERY OF THE RED LAKES, MINNESOTA. Fishery Bulletin 157 from Fishery Bulletin of the Fish and Wildlife Service, Vol. 60, pp. 33-41.

The goldeye, Amphiodon alosoides (Rafinesque) formerly an important species in the fishery of the Red Lakes, Minnesota, has been reduced in abundance during recent years. The decline has been significantly correlated with increased fishing effort but not with abundance of predaceous species. Growth rates of the sexes are similar in earlier years of life but the females grow faster in later years. Growth is positively correlated with summer temperatures and shows marked differences in different years. Fish attain maximum availability to commercial gill nets at a length of 13.0 to 13.4 inches and an age of 4 to 5 years. The commercial take is dependent on two or three age groups and annual abundance is strongly influenced by the strength of individual year classes. Management would be limited to control of fishing effort, but it cannot be practiced in the fishery unless entrapment gear is used instead of gill nets. (Auth. abst.)

3039. Nelson, Philip R. 1959. EFFECTS OF FERTILIZING BARE LAKE, ALASKA, ON GROWTH AND PRODUCTION OF RED SALMON (O. NERKA). Fishery Bulletin 159 from Fishery Bulletin of the Fish and Wildlife Service, Vol. 60, pp. 59-86.

Bare Lake, a 120-acre, unstratified lake on Kodiak Island, Alaska, was fertilized each year from 1950 to 1956 with inorganic fertilizers to determine whether fertilization will increase production of red salmon (Oncorhynchus nerka). Various phases of the life history of the species were studied.

From 1950 through 1956 the annual spawning population of red salmon in Bare Lake ranged from 52 to 551 fish. Red salmon vary in age at maturity. The majority of Bare Lake red salmon remain in the lake slightly longer than a year, then migrate to the sea to spend three years before returning to the lake to spawn. Females predominated over males in the spawning escapement each year. Data are presented on fecundity, egg retention, and the annual egg deposition.

A relation was found between the growth of young red salmon and the gross rate of photosynthesis. Fertilization has brought about an increase in size of the seaward-migrating red salmon smolts. There is good evidence to show that the larger smolts survive in greater numbers at sea. For the years 1950-53, fresh-water survival has ranged from 1.0 to 5.1 percent and marine survival increased from 3.3 to

7.9 percent. Limited information is available on the effect of fertilization on other fish populations in Bare Lake. (Auth. abst.)

3040. Graham, Joseph J. 1959. NORTHEASTERN PACIFIC ALBACORE SURVEY. PART I. BIOLOGICAL OBSERVATIONS. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 310, 33 pgs.

This report lists the biological data collected aboard research vessels Hugh M. Smith and John R. Manning and nine chartered commercial vessels during the Northeastern Pacific Albacore Survey (NEPAS). The survey was developed to map the distribution of albacore in the northern area of the United States west coast albacore fishery during the summer of 1957. (Auth. abst.)

3041. Favorite, Felix, and Glenn Pedersen. 1959. BRISTOL BAY OCEANOGRAPHY, AUGUST-SEPTEMBER 1938. U.S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 311, 31 pgs.

Oceanographic observations tabulated from the files of the U. S. Fish and Wildlife Service and from the official logs of the U. S. Coast Guard Tug Redwing present values of temperature, salinity, density, dynamic heights, and dissolved oxygen at 128 stations, current measurements at 29 stations including 4 tidal cycles, and descriptions of the bottom from samples at 56 stations. Several horizontal and vertical sections of temperature, salinity, and density have been constructed to show the gross features of the oceanographic conditions in the eastern section of Bristol Bay, Alaska. (Auth. abst.)

3042. Angela Bol, A. C. 1959. A CONSUMMATORY SITUATION. THE EFFECT OF EGGS ON THE SEXUAL BEHAVIOR OF THE MALE THREE-SPINED STICKLEBACK (GASTEROSTEUS ACULEATUS L.) Experientia, Vol. 15, No. 3, pg. 115; Biological Abstracts, Vol. 34, No. 1, Abst. No. 492, 1959.

The decrease in sexual motivation of the stickleback following fertilization of eggs appears to be due to the exposure of the male to eggs. (E.H.S.)

3043. DE ANGELIS, Costanzo M. 1958. METHODS OF RESEARCH ON THE PRODUCTIVITY OF THE SEA. (METODI DI RICERCA SULLA PRODUTTIVITA DEL MARE.) Boll. Pesca, Piscicolt. e Idrobiol., Vol. 12, No. 2, pp. 159-211; Biological Abstracts, Vol. 34, No. 1, Abst. No. 526, 1959.

The main factors influencing the productivity of the sea are summarized, techniques used in the study are discussed and criticized. Productivity in the Mediterranean, based on published reports is also discussed. The bibliography is extensive. (M.G.)

3044. Sommani, Ernesto. 1958. LIMNOLOGY OF ARTIFICIAL LAKES. VI. CONCLUDING OBSERVATIONS. (LIMNOLOGIA DEI LAGHI ARTIFICIALI. VI. OSSERVAZIONI CONCLUSIVE.) Boll. Pesca, Piscicolt, e Idrobiol., Vol. 12, No. 2, pp. 212-231; Biological Abstracts, Vol. 34, No. 1, Abst. No. 533, 1959.

Observations made over a 10-year period on artificial lakes in various regions of Italy are summarized. Artificial lakes often have characteristics of natural lakes of landslide or glacial origin. In the Alpine region, the water supply is greatest from the middle of May to the middle of August; in the peninsula region and islands it is greatest from Nov. to March. The greatest difference between artificial and natural lakes is the outflow of water from the depths. The cessation or lowering of the thermocline and the hypolimnion greatly modifies the thermic behavior of artificial lakes. Artificial lakes at no more than 1000 m are generally eutrophic, in spite of their notable depth. Eutrophy is determined by the abundance of nutritive matter collected in the basin from the surrounding land and from the increase between epilimnion volume/hypolimnion volume, relative to natural lakes with the same morphological characteristics. The colonization of artificial lakes is very rapid and depends on surrounding factors rather than from the more or less recent invasion of water into the basin. Factors opposing the development of plankton are: too rapid change of water, excessive turbidity, and periods of outflow. Species with a rapid reproduction rate generally prevail because of the frequent destruction occurring during unfavorable periods. Finally, the ageing process of the artificial lakes and its effect upon the ichthyofauna is discussed. (Auth. summ.)

3045. Tseyeb, Y. Y., and G. A. Olivari. 1958. AN EXPERIMENT IN THE TRANSPORTATION OF FOOD INVERTEBRATES FOR INTRODUCTION. (OPYT PEREVOZKI KORMOVYKH BESPOZVONODHNYKH DLYA INTRODUKTSII.) Priroda 1958(6): 104-105; Biological Abstracts, Vol. 34, No. 1, Abst. No. 555, 1959.

In the summer of 1956 and 1957, 36 million polycheates, oligochaetes, mollusks and crustaceans were transferred from the Dnepr delta and the Ingulets river to the water reservoir of Kakhovka. Two floating-aquarium vessels were used, each with a holding capacity of 30 cu m of water and a 0.75 m draught. They were also furnished with bottom sand and pond weeds to create conditions similar to those in the river. It took 2 days to cover the distance of 280-300 km. Such a mass transportation of invertebrates is the best solution in cases where animals were urgently needed in large quantities to feed fish. (OTS)

3046. Halver, John E., Donald C. DeLong, and Edwin T. Mertz. 1957. NUTRITION OF SALMONOID FISHES. V. CLASSICATION OF ESSENTIAL AMINO ACIDS FOR CHINOOK SALMON. J. Nutrition, Vol. 63, No. 1, pp. 95-105; Biological Abstracts, Vol. 34, No. 1, Abst. No. 829, 1959.

Chinook salmon (Oncorhynchus tshawytscha) were divided into 20 lots of 200 each, average

weight of individuals per lot, 1.9 to 2.0 gm. Two lots were fed a control diet (Halver, Journal of Nutrition, in press) containing (in %), L-amino acid mix 35, carboxymethylcellulose 5, dextrin 3, corn oil 2.5, minerals 2, vitamin mix and cellulose 1.5, cod liver oil 1, and water 50. Other lots were fed a modification of the control diet in which a-cellulose flower replaced one of the 18 amino acids. At the end of 6 weeks the average total weight increases of individuals per lot were (in gm): controls 0.76 and 0.83 (lots 3 to 20, respectively, devoid of): arginina - 0.1 histidine 0.1, isoleucine 0.0, leucine - 0.2, lysine 0.0, methionine 0.1 phenylalanine 0.1, threonine 0.0, tryptophan 0.0, valine 0.0, alanine 0.75, aspartic acid 0.85, cystine 0.83, glutamic acid 0.94, glycine 0.95, proline 0.85, serine 0.89, tyrosine 0.78. At the end of six weeks lots 3 to 12 inclusive were divided into two equal sub-lots, one to be continued as before, the other placed on the control diet. A prompt growth response was observed in all sub-lots returned to the control diet. Arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine were required for growth. The salmon differs from the rat and pig, however, in its failure to synthesize any significant amounts of arginine.

3047. Ito, K. 1957. AMINO ACID COMPOSITION OF THE MUSCLE EXTRACTS OF AQUATIC ANIMALS. Bull. Japanese Soc. Sci. Fish., 23 (7 and 8): 497-500. (In Japanese with English summ.); Biological Abstracts, Vol. 34, No. 1, Abst. No. 831. 1959.

Seventeen amino acids in the aqueous alcoholic extracts of four species of fish and two species of mollusks, were determined microbiologically after hydrolysis. In fish with reddish meat (Scomber and Trachurus), the histidine content was high and in those with white meat (Mylio and Fugu), it was almost negligible. The pattern of the other amino acids was very similar in both species. In 4 species of fish, the proportion of amino acid N (except histidine) in the total N of the extracts varied considerably from species to species, but showed a relatively constant level, 8-10%. Lysine occupied an unique place in the extracts of Fugu. The muscles of Sepia showed high values in extractive N and also in the extractive amino acids, in which proline, alanine, serine, arginine and glycine were found to be prominent. On the other hand, the extracts of Octopus revealed very low values for all amino acids determined, except arginine, although the total amount of the extracted N was not less. Creatine and creatinine were also analyzed and accounted for 30 to 40% of the N in the extractives. (Auth.)

3048. Halver, John E. 1957. NUTRITION OF SALMONOID FISHES. III. WATER-SOLUBLE VITAMIN REQUIREMENTS OF CHINOOK SALMON. J. Nutrition, Vol. 62, No. 2, pp. 225-243; Biological Abstracts, Vol. 34, No. 1, Abst. No. 859. 1959.

A vitamin-test diet for chinook salmon (Oncorhynchus tshawytscha) was developed which contained (in %) vitamin-free casein supplemented with DL-methionine and L-tryptophan 55, purified gelatin 15, corn oil 9, white dextrin 8, alpha-cellulose flour 9, and mineral mixture 4. To 100 gm of this basal diet was added (in mg) thiamine-HCl 6, riboflavin 20, pyridoxine-HCl 4, nicotinic acid 80, calcium pantothenate 28, inositol 400, biotin, 0.6, folic acid 1.5, p-aminobenzoic acid 40, choline 800, ascorbic acid 200, alpha tocopherol acetate 40, menadione 4, beta carotene 1.2, activated 7-dehydrocholesterol 0.0045, and crystalline vitamin B_{12} 0.009. The diet was prepared by adding the other dry ingredients to a warm 5% gelatin solution and blending thoroughly in a mechanical mixer. Preparation as a floating or sinking diet could be obtained by altering the speed of the mixer. A floating diet containing 25% solids was found optimum for initial feeding and a slowly sinking diet containing 30% solids was found acceptable for more advanced feeding. By deleting the purified vitamins one at a time from this diet, deficiency syndromes in chinook salmon were observed for thiamine, riboflavin, pyridoxine, pantothenic acid, inositol, biotin, choline and folic acid. The results with nicotinic acid and vitamin B_{12} suggested requirement, but lack of ascorbic acid and p-aminobenzoic acid did not produce any recognizable deficiency symptoms.

3049. Snieszko, S. F., E. M. Wood, and W. T. Yasutake. 1957. INFECTIOUS PANCREATIC NECROSIS IN TROUT. Arch. Pathol., Vol. 63, No. 3, pp. 229-233; Biological Abstracts, Vol. 34, No. 1, Abst. No. 1052. 1959.

Infectious pancreatic necrosis in fingerling brook trout, Salmo gairdneri, is characterized by a hyaline degeneration of the striated muscle fibers, and acute pancreatic necrosis. These histopathological changes, the infectious character of the disease, and the increased susceptibility of very young trout compared with older fish suggest the possibility that the disease may be caused by an agent having the characteristics of the Coxsackie group of viruses. (M. D. S.)

3050. Fukuda, H. 1958. ON THE BLOOD SUGAR OF FRESH WATER FISH. Bull. Japanese Soc. Sci. Fish., Vol. 23, No. 12, pp. 782-784 (In Japanese with English summary); Biological Abstracts, Vol. 34, No. 1, Abst. No. 1148. 1959.

Blood sugar of pond cultured fish or gentle stream fish ranges from 15 to 40 mg/dl, while that of the fish living in a rushing stream have high contents of blood sugar, from 59 to 129 mg/dl. The highest value of blood sugar content is found with "yamame" trout, Oncorhynchus milkschitsch (129-131 mg/dl), while the lowest value of 19 mg/dl in the normal state is found in Anguilla japonica and Parasilurus asotus. (Auth.)

3051. Harrington, Robert Whiting, Jr. 1957. SEXUAL PHOTOPERIODICITY OF THE CYPRINID FISH, NOTROPIS BIFRENATUS (COPE), IN RELATION TO THE PHASES OF ITS ANNUAL REPRODUCTIVE CYCLE. J. Exp. Zool, Vol. 135, No. 3, pp. 529-556; Biological Abstracts, Vol. 34, No. 1, Abst. No. 1310. 1959

From September 26, Bridled Shiners, Notropis bifrenatus, were exposed to either normal daylight or 17 hours of daily light. In daylight (short photoperiod) September to January, sexual quiescence persisted, with testicular status quo (stages up to primary spermatocytes) and with oogenesis continuing slowly to a phase with a critical maximum egg diameter of 336 μ (reached by some eggs by October 26). Summer-length days (long photoperiod) advanced the first spawning 5 1/2 months, to January 1. By June (normal spawning period), the unseasonable January offspring and fish under daylight from September (short photoperiods lengthening into long) were ripe. Annually, a postspawning (refractory) period (mid-July to mid-November) alternates with a responsive period (mid-November to mid-July). Long photoperiods imposed within the responsive period promptly initiate a prespawning period, with the onset of a prespawning mechanism governing occurrence of nuptial color, sexual behavior and completion of gametogenesis, and measured by egg diameter increments in excess of 336 μ. Before mid-November long photoperiods fail to activate the prespawning mechanism, do not affect spermatogenesis, but accelerate egg diameter increase up to but not beyond 336 μ. The 6 1/2 week prespawning periods of Notropis and of the centrarchid, Enneacanthus obesus, which end with the first spawning (beginning of spawning period), appear to represent that phase of the over-all sexual cycle set right annually by the celestial clock.

3052. Gibbs, Sarah Preble. 1956. THE ANATOMY AND DEVELOPMENT OF THE BUCCAL GLANDS OF THE LAKE LAMPREY (PETROMYZON MARINUS LINNAEUS) AND THE HISTOCHEMISTRY OF THEIR SECRETION. J. Morph. 98(3), pp. 429-470; Biological Abstracts, Vol. 34, No. 1, Abst. No. 1845. 1959.

Adult lake lampreys possess a prominent pair of sac-like buccal glands which produce a secretion known to have anticoagulating, hemolytic, and cytolytic properties. Each gland is situated on the ventral side of the head at the level of the eyes, imbedded in the basilaris muscle, and is drained by a duct which opens into the mouth just inside the infraoral lamina. In feeding lampreys, the secretory epithelium of the gland is typically pseudostratified, and its tall, narrow cells contain scattered lipid droplets, small apical PAS-positive secretory granules, abundant granular mitochondria, and prominent basal chromidial substance. In migrating and spawning lampreys, the epithelium regresses rapidly: the cells become low columnar or cuboidal, the lipid droplets and PAS-positive secretory granules increase in size, the number of mitochondria decreases, and the basal chromidial substance disappears. These changes support the contention that the buccal glands function only during feeding. A preliminary histochemical analysis of the two recognized constituents of the secretion indicates that the lipid droplets have triglyceride-containing centers surrounded by phospholipid-rich shells and that the PAS-positive substance of the colloid is probably a mucco- or glycoprotein or possibly a neutral mucopolysaccharide. The development of the buccal glands and their ducts is described in detail for a closely graded series of transforming ammocoetes..

3053. Bittel, Leon. 1957. THE CRUSTACEAN PLANKTON OF LAKE DRUZNO. (PLANKTON SKORUPIAKOWY JEZIORA DRUZNO.) Ekol. Polska, Vol. 5, No. 6, pp. 187-213; Biological Abstracts, Vol. 34, No. 2, Abst. No. 2376. 1959.

In the Crustacean plankton of the lake Druzno it was established that there are 24 species of Cladocera and 17 species of Copepoda. Samples from the very bottom of the lake were not taken in consideration, thus the list of species living in the lake may not be complete. Typical eulimnetic forms were scarce. In all seasons of the year, with the exception of winter, phytoplankton shows preponderance over zooplankton. In the zooplankton rotifers with many heleoplanktonic forms are prevalent. During the winter only, due to the presence of very small absolute amounts of plankton, the quantitative relations of Crustaceans and Rotifers are more balanced. Generally the Crustacean plankton of Lake Druzno has a pond-plankton character, and a small number of limnetic forms are able to exist on account of the large surface of the lake. Some elements of hyphalmyroplankton are also characteristic. (From auth. summ.)

3054. Lambou, Victor W. 1958. GROWTH RATE OF YOUNG-OF-THE-YEAR LARGEMOUTH BASS, BLACK CRAPPIE, AND WHITE CRAPPIE IN SOME LOUISIANA LAKES. Proceedings of the Louisiana Academy of Science 21: 63-69; Biological Abstracts, Vol. 34, No. 2, Abst. No. 3487. 1959.

Micropterus salmoides, Pomoxis nigromaculatus and Pomoxis annularis were seined from five lakes in the northern part of the state. Young largemouth bass reached a total length of 3-1/2 to 4-1/2 inches during the first growing season, which ended in October. Young crappies of both species reached a total length of approximately three inches during their first growing season which also ended in October. (G. H. P.)

3055. DeLong, Donald C., John E. Halver, and Edwin T. Mertz. 1958. NUTRITION OF SALMONOID FISHES. VI. PROTEIN REQUIREMENTS OF CHINOOK SALMON AT TWO WATER TEMPERATURES. J. Nutrition, Vol. 65, No. 4, pp. 589-600; Biological Abstracts, Vol. 34, No. 2, Abst. No. 3759. 1959.

In order to find a suitable protein level for determining minimum amino acid requirements, total nitrogen requirements have been investigated. Hatchery chinook salmon (Oncorhynchus tshawytscha) were divided into five lots of 200 each, one lot per trough, average weight of individuals per lot, 1.5 gm. All lots were fed diets containing amino acid mix, casein, and gelatin with a balance of essential amino acids similar to whole egg protein, also dextrin, corn oil, cod liver oil, minerals, carboxymethycellulose, vitamins, and water. The five lots received respect-

ively, rations containing 13, 26, 39, 52 and 65% of total protein, dextrin replacing protein to keep the rations approximately isocaloric. Water temperature was maintained at 43 to 47°F. At the end of 10 weeks, maximum gain was observed at the 39% protein level. A second experiment at the same temperature with 150 fish per lot, average weight 5.8 gm, with 9 protein levels at 5% increments from 25% protein to 65% protein again gave maximum gains at about 40% total protein. The above two trials were duplicated at a water temperature of 58° F. using fish with average weight of 2.6 and 5.7 gm respectively. In the first trial maximum gains were observed at 65% protein; in the second, at 55 and 65% protein.

3056. Anonymous. 1959. GRANULAR HERBICIDES FOR AQUATIC WEEDS. Agric. Chemicals, Vol. 14, No. 1, pp. 31-32; Biological Abstracts, Vol. 34, No. 2, Abst. No. 5455. 1959.

The use of 2, 4-D pellets for aquatic weed control is reviewed. It is claimed that this herbicide (1) controls Elodia, milfoil, fan wort, tape grass and Ludwigia, (2) controls or retards emergent weeds such as lilies, cattails and alligator-weeds, and (3) greatly reduces many types of algae. Methods of application are described. The relatively low concentration of herbicide employed causes no injury to fish or other animal life or to trees or shrubs on the banks of treated ponds. (M. D. S.)

3057. Bogitsh, B. J., and T. C. Cheng. 1959. PISCIAMPHISTOMA REYNOLDSI (PARAMPHISTOMATIDAE) A NEW TREMATODE PARASITE OF LEPOMIS SPP. IN VIRGINIA. Jour. Tennessee Acad. Sci., Vol. 34, No. 3, pp. 159-162; Biological Abstracts, Vol. 34, No. 2, Abst. No. 5787. 1959.

Pisciamphistoma reynoldsi is described from Lepomis macrochirus Ref. and L. gibbosus L. from Albemarle County, Virginia. The status of the genus Pisciamphistoma Yamaguti, 1953 is discussed and the authors are in agreement with Yamaguti that this genus should be considered independent of the older Paramphistomum Fischoeder, 1901. The newer genus now includes 2 piscine trematodes, P. stunkardi and P. reynoldsi. (T. C.)

3058. Fritts, Donald H. 1959. HELMINTH PARASITES OF THE FISHES OF NORTHERN IDAHO. Trans. Amer. Microsc. Soc., Vol. 78, No. 2, pp. 194-202; Biological Abstracts, Vol. 34, No. 2, Abst. No. 5793. 1959.

Two hundred fifty-seven fish representing 14 species and 8 families collected from 10 different areas were examined for helminth parasites. Twenty species of worm parasites were found in the study, 3 of them new. Six species of trematodes were encountered, one of which is regarded as new. Eight species of cestodes were identified; two of these are described as new. Five species described include Plagiocirrus testeus n. sp., a trematode, taken from the large-scaled sucker (Catostomus macrocheilus Girard) Corallobothrium intermedium n. sp. and Corallobothrium minutium n. sp., cestodes from the brown bullhead (Ameiurus nebulosus (LeSueur)). An attempt to produce the adult of Dibothriocephalus spp. by feeding plerocercoids to a cat was unsuccessful. (D. H. F.)

3059. Sogandares-Bernal, Franklin, and Robert F. Hutton. 1959. STUDIES ON HELMINTH PARASITES FROM THE COAST OF FLORIDA. III. DIGENETIC TREMATODES OF MARINE FISHES FROM TAMPA AND BOCA CIEGA BAYS. Jour. Parasitol., Vol. 45, No. 3, pp. 337-346; Biological Abstracts, Vol. 34, No. 2, Abst. No. 5802. 1959.

The following trematodes are reported from Tampa and/or Boca Ciega Bays: Prosorhynchus sp. from Chilomycterus schoepfi; Diploproctodaeum plicitum from Chilomycterus schoepfi and Lagocephalus laevigatus; Diploprodtodaeum vitellosum from Lagocephalus laevigatus; Multitestis rotundus from Archosargus probatocephalus; Stephanostomum ditrematis from Caranx hippos; Stephanostomum sp. from Acanthostracion tricornis; Stephanostomum promicropsi from Promicrops itiara; Opecoeloides fimbriatus n. comb. from Penaeus duorarum; Lasiotocus minutum n. comb. from Fundulus similis; and Diphterostomum americanum from Gobiosoma robustum, Lagodon rhomboides, and Opsanus beta. Information pertaining to the exact location of each trematode species within its respective host(s) is given when possible. (Authors)

3060. Clark, Clarence F., and Frank Steinbach. 1959. OBSERVATIONS ON THE AGE AND GROWTH OF THE NORTHERN PIKE, ESOX LUCIUS L. IN EAST HARBOR, OHIO. Ohio Jour. Sci., Vol. 59, No. 3, pp. 129-134; Biological Abstracts, Vol. 34, No. 2, Abst. No. 5953. 1959

This study is based on scale samples taken from 688 northern pike, caught in East Harbor during the years 1951 through 1953. Maximum ages of the pike were 10 years for 4 females and 8 years for 4 males. The large percentage of the pike, each year, were 5 years of age or younger. In 1953, nearly 70% were 3 years old or younger. Although a difference in growth was noted between males and females, the average northern pike from East Harbor reached calculated lengths of 11.4 inches at the end of their first year of life, and 17.6, 21.2, 23.6, 25.5, 26.4, 28.6, 30.1, 31.2, and 32.8 inches during successive years. Due to a longer life span, the females grew to the largest sizes. (Authors)

3061. Cope, Oliver B. 1956/57. THE CHOICE OF SPAWNING SITES BY CUTTHROAT TROUT. Proc. Utah Acad. Sci., Arts and Letters, 34: 73-79; Biological Abstracts, Vol. 34, No. 2, Abst. No. 5954. 1959.

Several environmental factors were examined in stream surveys on 6 Yellowstone Lake tributaries used by cutthroat trout for spawning. An attempt was made to relate the distribution of redd in each stream with factors known sometimes to influence the choice of spawning sites. The distribution of the best gravel and the presence of waterfalls, log jams, and chemical

barriers can account for the distribution of nests in most of the streams. No explanation is at hand, with our limited knowledge to reveal why more spawning did not take place in upstream areas in Chipmunk Creek; the spawners shunned what seemed to be ideal spawning territory in the middle stretches and used the lower sections. The influences of forest cover and stream gradient on distribution of spawning in the streams were studied, but no effects were apparent. A theory applying to the use by migrating spawners of the headwater areas by the first part of the migration and downstream sections by the later parts of the run was examined in the light of experience with cutthroat in these streams. Arnica, Chipmunk, and probably Pelican Creek fish support the theory; Clear Creek fish were the only ones appearing to refute the hypothesis. (Auth. summ.)

3062. Olson, Harold F. 1957. AGE AND GROWTH OF THE UTAH CHUB, GILA ATRARIA (GIRARD) IN FISH LAKE, UTAH. Proc. Utah Acad. Sci., Arts and Letters 34:83-85; Biological Abstracts, Vol. 34, No. 2, Abst. No. 5960. 1959.

Fish Lake is a deep oligotrophic lake. The scale method was used to determine age. The body-scale ratio was relatively constant throughout the life of the fish. The maximum yearly growth is during the first two years. With an increase in age, the condition factor (K) decreases, probably because of competition for an inadequate food supply. (From auth. summ.)

3063. Thorson, Thomas B. 1959. PARTITIONING OF BODY WATER IN SEA LAMPREY. Science 130(3367): 99-100; Biological Abstracts, Vol. 34, No. 2, Abst. No. 5963. 1959.

Measurements were made of the partitioning of total body water in the sea lamprey, Petromyzon marinus, between intracellular and extracellular compartments and the division of the latter into interstitial fluid and plasma. The apportionment of body water in agnathans is very similar to that in elasmobranchs, and both of these primitive groups differ from what is known of the more advanced teleosts. (Auth. abst.)

3064. Davis, Charles C. 1959. DAMAGE TO FISH FRY BY CYCLOPOID COPEPODS. Ohio Jour. Sci., Vol. 59, No. 2, pp. 101-102; Biological Abstracts, Vol. 34, No. 3, Abst. No. 6388. 1959.

An attack by Mesocyclops edax is described upon a 6.5 mm fry of rockbass, Ambloplites rupestris. Copepod concentration corresponded to 500/liter. In an hour the fry was badly damaged, but not killed. (Auth. abst.)

3065. McCarraher, D. Bruce. 1959. PHYLLOPOD SHRIMP POPULATIONS OF THE BIG ALKALI LAKE DRAINAGE, NEBRASKA AND THEIR RELATIONSHIP TO YOUNG PIKE (ESOX LUCIUS). American Midland Nat., Vol. 61, No. 2, pp. 509-510; Biological Abstracts, Vol. 34, No. 3, Abst. No. 6396. 1959.

Fairy shrimp and tadpole shrimp populations are seasonably abundant throughout the Big Alkali Lake drainage. Early spring sampling revealed co-habitation of 2.5-3.5 inch pike fingerlings with shrimps in many prairie pools. Growth rates of fingerling pike in shrimp habitat exceeded growth of pike in non-shrimp areas. (Auth. abst.)

3066. Bulkley, Ross V. 1957/58. THE FOOD OF ADULT FISH LAKE TROUT AND ITS RELATION TO FORAGE FISH ABUNDANCE. Proc. Utah Acad. Sci., Arts and Letters, 35:85-89; Biological Abstracts, Vol. 34, No. 3, Abst. No. 6452. 1959.

Young lake trout in Fish Lake feed on invertebrates (scuds, leeches, and water fleas), but adult fish feed principally on Utah chubs and rainbow trout. Ease of capture dictates which of these two species of fish will be eaten. In 1956 chubs were taken in midsummer after they completed spawning and moved out into the deeper water. Rainbow trout were taken most commonly during the two periods when heavy plantings of this species were made. The lake trout appeared to feed exclusively on hatchery rainbows immediately following the plantings. Large lake trout easily ingested fish up to ten inches in length, the approximate maximum size planted in 1956. (Auth. summ.)

3067. Parisot, T. J. 1959. TUBERCULOSIS OF FISH: A REVIEW OF THE LITERATURE WITH A DESCRIPTION OF THE DISEASE IN SALMONOID FISH. Bact. Revs., Vol. 22, No. 4, pp. 240-245; Biological Abstracts, Vol. 34, No. 3, Abst. No. 8188. 1959.

Four Mycobacteria, Mycobacterium marinum, M. platypoecilis, M. piscium (not recognized by Bergey's Manual, 7th ed.), and M. anabanti (never recognized) are described, and a history given of their discovery in spontaneously occurring infections of fish, as well as of experiments in adaptation of mammalian tuberculosis to fish, and of fish acid-fast bacilli to warm-blooded animals. Studies of the effect of passage of human tubercle bacilli in cold-blooded animals seem to indicate that the virulence for the cold-blooded animal is increased as the virulence for the warm-blooded animal is decreased or lost. Early surveys of natural populations led to the conclusion that M. piscium (first observed in captive fish living in water contaminated by the sputa of tuberculous persons) was non-pathogenic for marine fishes. A number of instances of infection of cold-blooded animals with M. marinum have since been studied, both in marine fishes and in zoological specimens (including marine, brackish water, and fresh water animals). In chinook salmon, Oncorhynchus tschawytscha, a disease caused by acid-fast bacilli is most often manifested as a military type, with extensive lesions of the liver, stunted growth, and/or lack of secondary sexual development. Other salmonoid fishes have been found to be susceptible, but only in hatchery stock. It is concluded that spread of the disease results in large part from the practice of feeding infected viscera and carcasses of adult salmon to hatchery fish. (M. D. S.)

3068. Graham, Jay E., and Russell D. Anderson.

1957/1958. THE EFFECTS OF MOSQUITO LARVICIDING ON OTHER ORGANISMS IN SALT LAKE COUNTY. Proc. Utah Acad. Sci., Arts and Letters, 35: 43-48; Biological Abstracts, Vol. 34, No. 3, Abst. No. 8753. 1959.

The destruction of mosquito larvae by the application of chemical agents to the water producing them has been practiced in parts of Salt Lake County for more than 30 years and in all of Salt Lake County for five years. The insecticides currently used are DDT, heptachlor, malathion, and parathion applied at 0.3, 0.1, 0.5, and 0.05 pounds per acre, respectively. At these concentrations no ill effects were observed in mammals, birds, reptiles, and amphibians although some frogs were killed by the application of parathion at several times the normal concentration. Dead carp have been observed after mosquito larviciding with DDT, but the careful application of parathion, which is less toxic to fish, will control mosquito larvae without loss of fish. Invertebrates are not affected uniformly. Crustaceans normally found in mosquito producing waters are apparently not harmed. Neither are larvae of the insect family Ephydridae. Spiders and aquatic insects, other than Ephydridae are adversely affected in varying degrees. Aquatic beetles seem to be affected more seriously than other insects excepting mosquito larvae. No indirect effects were noted, and the literature indicates that such effects, if they exist at all under conditions of mosquito larviciding in Salt Lake County, are negligible. Milk and meat can become contaminated with DDT but heptachlor, malathion, and parathion can be used around livestock without danger at the concentrations required for mosquito larviciding. DDT, heptachlor, malathion, and parathion, properly used, can be effective for control of mosquito larviciding without any detrimental effects on vertebrates and with insignificant effects on invertebrates. (Auth. summ.)

3069. Menzel, R. W. 1958. FURTHER NOTES ON THE ALBINO CATFISH. Jour. Heredity, Vol. 49, No. 6, pp. 284, 293; Biological Abstracts, Vol. 34, No. 3, Abst. No. 8962. 1959.

Albino channel catfish, Ictalarus punctatus, (Raf.) are still present in the Pamunkey River in Virginia, 15 years after they were first reported. After transplantation to another river system (Chickahominy), albino fish were not seen after five or six years. (Auth. abst.)

3070. Gunter, Gordon, and William E. Shell, Jr. 1958. A STUDY OF AN ESTUARINE AREA WITH WATER-LEVEL CONTROL IN THE LOUISIANA MARSH. Proc. Louisiana Acad. Sci. 21: 5-34; Biological Abstracts, Vol. 34, No. 4, Abst. No. 9424. 1959.

Aquatic fauna of two large estuarine lakes, White and Grand Lakes, and connecting bay were sampled by net hauls approximately every four months from Sept., 1951 to June, 1953. Lakes are in the coastal marsh of western Louisiana and lie within the reservoir area of the Mermentau River Project, which was designed to prevent floods and to hold back fresh water for use of rice farmers. Water temperatures ranged from 12.4 to 34.5°C and salinity ranged from 0.08 to 4.05 0/00. Fauna was a mixture of freshwater and marine species, but the marine element was dominant. Young of many coastal species grow in estuarine waters, and most marine specimens taken were young. Most abundant fishes were menhaden, anchovies, and croakers; Penaeus setiferus and Rangia cuneata were the most abundant invertebrate animals. Present general program of opening and closing the lock gates will not interfere with commercially and economically important marine species, with possible exception of Penaeus setiferus. (G.H.P.)

3071. Rehder, Dudley Dean. 1959. SOME ASPECTS OF THE LIFE HISTORY OF THE CARP, CYPRINUS CARPIO, IN THE DES MOINES RIVER, BOONE COUNTY, IOWA. Iowa State Jour. Sci. 34(1): 11-26; Biological Abstracts, Vol. 34, No. 4, Abst. No. 9464. 1959.

Carp were collected, mostly with an electric shocker, from a 7-mile section of Des Moines River in 1958 and fall of 1957. Weight was found to increase as 3.02456 power of total length, but difference from cube relationship was not statistically significant. Condition factor, C, therefore, showed no trend with length of fish. Length-weight relationships of male and female carp were similar. Condition factors were highest in midsummer, at time of high water level. On the average, standard lengths equal 0.798 total lengths and fork lengths equal 0.89 total lengths, with conversion factors being somewhat higher as length of fish increases. Scales and opercles were used in determining age and growth rates. Age determinations from these two structures were in agreement in 84.5% of fish. Resumption of growth was evident on opercle earlier in spring than on scales. Body-opercle relationship was more nearly rectilinear and showed better correlation than body-scale relationship. Growth of carp in Des Moines River appears to be about average in comparison to published reports. A few of each sex mature at age II. Presence of two sizes of eggs in ovaries of some females indicated a possible spread of spawning season. Number of eggs per female increased with age and size. Age IV females averaged 181,000 eggs. Most abundant year class, 1956, was produced during a year of low stable water levels. During summer of 1958, carp fed mostly on seeds (22.3%), other plant material (54.8%), and insects (10.3%). Earthworms and terrestrial insects comprised most of food during floods. An unsegmented tapeworm tentatively identified as Caryophyllaeus laticeps was found in many carp. Although a common parasite of carp in Europe, it has not been reported previously in America. (Auth. abst.)

3072. Renfro, William C. 1959. SURVIVAL AND MIGRATION OF FRESH-WATER FISHES IN SALT WATER. Texas Jour. Sci., Vol. 11, No. 2, pp. 172-180; Biological Abstracts, Vol. 34, No. 4,

Abst. No. 9465. 1959.

Experiments on selected spp. of fresh-water fishes in increasing concentrations of sea salt solutions indicate that many have physiological ability to tolerate brackish salinities for at least short periods of time. Theory is advanced that fresh-water fishes utilize brackish waters as avenues for migration to suitable new environments with resulting range extensions. Recent collections of fresh-water fishes in brackish waters are cited in support of the theory. (W. C. R.)

3073. Wilkinson, L. 1959. SAMPLING OF TIDAL WATERS. New Zealand Jour. Sci., Vol. 2, No. 2, pp. 196-207; Biological Abstracts, Vol. 34, No. 4, Abst. No. 9492. 1959.

An investigation has been made of the effect of monthly and twice-daily changes in the tides on the composition of the tidal waters of two low-lying rivers flowing into a common estuary with a narrow outlet to the sea. The variations in composition found emphasize the difficulty of obtaining a sequence of comparative samples at times other than low water. The results show that, in assessing the degree of pollution, the mean of a few low-water samples and the mean of a large number of samples taken at all stages of the tide had virtually the same significance. (Auth. summ.)

3074. Mel'nikov, G. B. 1958. ON THE STUDY OF THE ZOOPLANKTON IN THE SIMFEROPOL' RESERVOIR. (KIZUCHENIYU ZOOPLANKTON SIMFEROPOL'SKOGO VODOKHRANILISHCHA.) Dopovidi Akad. Nauk Ukrain. RSR 1958(8): 893-896; Biological Abstracts, Vol. 34, No. 4, Abst. No. 9495. 1959.

The Simferopol' reservoir was formed on the Salgir river near Simferopol' in 1954. Its maximum depth is 37 m and its capacity amounts to 36 million m^3. The hydrobiology of this reservoir has been studied since 1955. Zooplankton of the Crimean inner reservoirs was studied by many investigators. Data is presented on the qualitative and quantitative development of the plankton in this reservoir, based on investigations conducted from 1955 to 1957. Zooplankton composition was replenished by Mesocyclops leuckarti, Daphnia cucullata and Leptodora kindtii transferred from the Dnepr reservoir in 1955. The greatest quantitative development in the reservoir, due chiefly to Cyclops vicinus and D. longispina, is observed in spring, autumn and winter. (OTS)

3075. Boudreaux, Jack, Kirk Strawn, and Gerald Callas. 1958(1959), FIRE ANTS, HEPTACHLOR, AND FISH KILL. Southwestern Nat., 3 (1/4): 7-12; Biological Abstracts, Vol. 34, No. 4, Abst. No. 9500. 1959.

Twenty pounds of 10% heptachlor were applied/acre on the northern half of the Fralise Farm near Sour Lake, Texas. Fish kill was heavy and continued for over three weeks. Young fish died first. The few survivors were usually large and, except for shad and gambusia, were thin. Two months after the poisoning, larvae of several species were found, and the population of fishes appeared to be on the way to recovery. During a later treatment of the southern part of the farm, extreme care was taken to avoid contamination of water with heptachlor. Fish kill was avoided. (Auth. abst.)

3076. Lindquist, Armin. 1958. FISHERY INVESTIGATIONS ON THE SEA TROUT IN THE PROVINCE OF BOHUSLAN, SWEDEN. (FISCHEREI-BIOLOGISCHE UNTERSUCHUNGEN AN DER MEERFORELLE IN DER PROVINZ BOHUSLAN (SCHWEDEN).) Inst. Marine Res. Lysekil, Ser. Biol. 9:1-23; Biological Abstracts, Vol. 34, No. 4, Abst. No. 9507. 1959.

Statistics are given as to numbers of trout caught, size, weight, sex, etc., in an attempt to understand better the age composition of the population, and decide on limitations which should be set. It was decided that only those individuals which are at least 35 cm long should be taken.

3077. Perlmutter, Alfred. 1959. CHANGES IN THE POPULATIONS OF FISHES AND IN THEIR FISHERIES IN THE MIDDLE ATLANTIC AND CHESAPEAKE REGIONS, 1930 to 1955. Trans. New York Acad. Sci. 21(6): 474-496; Biological Abstracts, Vol. 34, No. 4, Abst. No. 9508. 1959.

The author points out that while the fragmentary picture of the changes in the populations of fishes and their fisheries in the middle Atlantic and Chesapeake regions is crude, as are the data on which it is based, nevertheless it does indicate the possibility that detrimental changes are occurring in the fisheries. The species considered include: Brevoortia tyrannus, menhaden; Pomolobus pseudoharengus, alewife; Micropogon undulatus, croaker; Cynoscion regalis, gray sea trout; Stenotomus chrysops, scup, Paralichthys dentatus, the fluke; and Centropristes striatus, sea bass. (J. F. A.)

3078. Orska, Janina. 1956(1957). THE INFLUENCE OF TEMPERATURE ON THE DEVELOPMENT OF THE SKELETON IN TELEOSTS. (In English with Russian and Polish summ.) Zool. Polaniae, Vol. 7, No. 3, pp. 272-325; Biological Abstracts, Vol. 34, No. 4, Abst. No. 10598. 1959.

Eggs of Salmo trutta and Salmo irideus subjected to 20°C and 2.5°C in various stages of development produced individuals with varied numbers of vertebrae and fin rays in the dorsal, anal and pectoral fins. It is suggested that such skeletal characteristics, considered of taxonomic importance, may be similarly affected under natural conditions, especially in fish which have fixed spawning places. (S. J.)

3079. Anonymous. 1958. THE FIRE ANT ERADICATION PROGRAM AND HOW IT AFFECTS WILDLIFE. Proc. Ann. Conf. Southeastern Association of Game and Fish Commissioners, 12: 1-34; Biological Abstracts, Vol. 34, No. 4, Abst. No. 11782. 1959.

This symposium includes: Introductory remarks, by Walter Rosene, Jr.; History of the imported ant

in the Southeast, by Ralph H. Allen, Jr.; The toxicity of some organic insecticides to fishes, by Clarence M. Tarzwell; Whistling-cock counts of bob-white quail on areas treated with insecticide and on untreated areas, Decatur County, Georgia, by Walter Rosene, Jr.; Observations of effects of an application of Heptachlor or Dieldrin on wildlife, by Maurice F. Baker; Fire ant eradication and wildlife, by Daniel W. Lay; Studies on the effect of the imported fire ant control program on wildlife in Louisiana, by Leslie L. Glasgow; A preliminary progress report of fire ant eradication program, Concordia Parish, Louisiana, June, 1958, by John D. Newsom; and A commentary on the fire ant problem, by Clarence Cottam (Director, Welder Wildlife Foundation, Sinton, Texas). This well-documented summary concludes: "The Southeastern Association Game and Fish Commissioners .... goes on record as opposing the broadcast application of dangerous insecticides until further information is obtained concerning effect on public health and fish and wildlife." (G. A. E.)

3080. Miaczynski, Tadeusz. 1956. MYXIDIUM PFEIFFERI AUERBACH AND THE ORIGIN OF THE SPOROZOAN CYSTS IN FISH KIDNEYS. Zool. Poloniae, Vol. 7, No. 1, pp. 121-126; Biological Abstracts, Vol. 34, No. 4, Abst. No. 11802. 1959.

The parasites were observed in the kidneys of the carp and of the crucian carp. These, and an unidentified myxosporidian from the kidney of the loach, appear to develop within the Bowman's capsule. (S. J.)

3081. Dyk, Vaclav. 1958. THYMALLUS IN CARPATHIAN RIVERS. (KHARIUS V KARPATSKIKH REKAKH.) Priroda 1958(10): 105-107; Biological Abstracts, Vol. 34, No. 4, Abst. No. 11961. 1959.

The distribution, habitat, habits and food of the Thymallus, found in the Carpathian rivers, are discussed. (OTS)

3082. Harrington, Robert W., Jr. 1959. DELAYED HATCHING IN STRANDED EGGS OF MARSH KILLIFISH, FUNDULUS CONFLUENTUS. Ecology, Vol. 40, No. 3, pp. 430-437; Biological Abstracts, Vol. 34, No. 4, Abst. No. 11965. 1959

The drying up of rain-flooded lowlands stranded eggs of the euryhaline fish, Fundulus confluentus, which remained unhatched yet viable after as much as three months' exposure. When ovigerous sods were immersed in tap water, normal fish hatched within 15-30 min. Eggs were found in moist plant debris on the soil surface at the forefront of prior flooding, at elevations first exposed by receding waters. Eggs so exposed survived unusually cold weather, and hatched in a swale reflooded by January rains. This deferred hatching is of special interest to the ecological physiology of hatching, as the eggs are not buried like those of the grunion and of exotic cyprinodonts with latent embryos, and because the latent period is so long. (Auth.)

3083. Mathieu. 1958. THE DETERMINATION OF SEX IN SOME SPECIES OF TILAPIA IN BREEDING PONDS AND IN H. FASCIATUS. (LA DETERMINATION DU SEXE CHEZ QUELQUES ESPECES DE TILAPIA D'ELEVAGE ET CHEZ HEMICHROMUS FASCIATUS PTRS.) Ann. Soc. Roy. Zool. Belgique 88: 369-372; Biological Abstracts, Vol. 34, No. 4, Abst. No. 11969. 1959.

Differences in color as a means of distinguishing between the sexes have proved unreliable in practice. The present paper described the characters of the genital papilla, which show sexual differences externally, for 3 spp. of Tilapia and for H. fasciatus.

3084. Matsumoto, Walter M. 1959. DESCRIPTIONS OF EUTHYNNUS AND AUXIS LARVAE FROM THE PACIFIC AND ATLANTIC OCEANS AND ADJACENT SEAS. Carlsberg Found. Oceanogr. Exped. Round the World 1928-30. Dana Rept. 50. 1-34; Biological Abstracts, Vol. 34, No. 4, Abst. No. 11970. 1959.

Larvae and post-larvae of E. alletteratus, E. lineatus, and E. yaito, and two forms of Auxis are described. Most of the material was collected by various Danish vessels, notably the research vessel "Dana" during an extended cruise in the North Atlantic and the Gulf of Panama from 1920-22, and during the round-the-world cruise from 1928-30. Other material included juveniles of Euthynnus and Auxis collected by various organizations from the Gulf of Mexico, the Pacific waters off Central America, and the Philippine waters. Two types of Auxis larvae were noted in the samples. However, in the absence of conclusive evidence, it was hypothesized that the two types represented variations of the same sp. Euthynnus larvae were generally found in waters closer to land masses than larvae of other spp. of tunas. The bulk of Auxis larvae were also found close to land, but captures in the middle of the Atlantic and up to 900 mi. from land in the Pacific indicated that this genus spawns farther away from land than Euthynnus. The presence of recently hatched larvae in the catches indicated that the locality of capture was in the vicinity of the spawning sites of these fishes. (Auth. summ.)

3085. Krauter, D. 1958. EXPERIMENTAL STUDIES OF THE INTERRENAL ORGANS OF BONY FISHES. (EXPERIMENTELLE UNTERSUCHUNGEN UBER DAS INTERRENALORGAN VON KNOCHENFISCHEN.) Wilhelm Roux Arch. Entwicklungsmech Organ, Vol. 150, No. 6, pp. 607-637; Biological Abstracts, Vol. 34, No. 5, Abst. No. 12167. 1959.

The interrenal organs of the teleosts Umbra krameri and Carassius auratus were studied by histological and histochemical techniques. In both, the nuclei enlarge and the number of mitoses increases after administration of ACTH. In U. krameri the organ becomes very vascular, so that the cell strands form a kind of network. A similar response is obtained after injury in this fish, with the number of mitoses increasing from 0 to 64 in 500 nuclei. The interrenal tissues of C. auratus do not respond to injury, and the nuclei of the interrenal cells do not become smaller after injection of desoxycorticosterone acetate. These cells do however

contain a sudanophilic lipid that is diminished after ACTH, whereas the cells in U. krameri contain no lipid. Ascorbic acid cannot be demonstrated in either species, although the administration of this substance to C. auratus results in transient storage. From these observations it is concluded that the interrenal organs lying in the head kidney of bony fishes are homologous to the adrenal cortex of higher vertebrates. It also appears that the adrenal-mediated response to stress is phylogenetically a very old mechanism. (F. M.)

3086. Carruthers, J. N. 1958. A LEANING-TUBE CURRENT INDICATOR ("PISA"). Bull. Inst. Oceanogr. (Monaco) 1126, 1-34; Biological Abstracts, Vol. 34, No. 5, Abst. No. 12471. 1959.

An account has been given of a very simple device which can be used either on an ordinary ground line fixed on the sea-bed beneath a buoy, or in a sort of cage lowered from a drifting ship, to make easily-repeatable single measurements of bottom current. The result obtained related both to speed and direction. The extremely simple instrument which can function at any depth is so sensitive that current speeds of 1/10-knot and less are measurable with certainty. The method consists in placing on the sea bottom a polythene tube which is 1 m long, 10 cm wide, and 6.3 mm in wall thickness. In this tube is placed a small glass bottle filled half with hot gelatine solution and half with colored vegetable oil. When this bottle is hot and the gelatine solution is therefore liquid, it is possible for a magnetized ceramic disc which is suspended from a nylon thread to turn freely and resolutely into the magnetic meridian. If the bottle be chilled while canted from the vertical a sloping interface between the two liquids is preserved. The polythene tube is closed at its base by means of a sealed-in plug from the center of which a short cord hangs externally. This cord is fastened to an anchor weight such that when submerged in motionless water, the polythene tube (which is just and only just buoyant) stands perfectly erect. Any current causes it to lean from the vertical to an angle which is interpretable into current speed on reference to a calibration curve built up from test made in a circulating water channel. Before use the bottle is heated by immersion in a can of hot water and is then fixed in the tube. The latter is then filled with hot water and its mouth closed by means of a rubber capping held on by stretched rubber bands. This ensures that the jelly in the bottle is still liquid when the bottom is reached. When used tethered down to a groundline the tube remains closed and is not raised until enough time has been allowed for its contained water and bottle to chill. When used from a drifting ship in a cage lowered on the standard hydrographical wire to just above bottom, a messenger is sent down the suspension wire. This causes the tube to jump out of the cage and to anchor itself. In doing so the rubber capping is snatched off thereby permitting escape of the warm water from the tube and ensuring quick chilling of the bottle in consequence. In this method of use the tube cannot be dragged by the drifting ship before the gelatine solution congeals because a long length of strong thin flexible wire has first to be pulled off from a free-running light drum located in the cage. Very successful use has been made of the simple instrument in Arctic waters by employing it in both of the ways just described, and also just below the surface of the sea under rough weather conditions and above more than a mile depth of water. (Auth. summ.)

3087. Darsie, Richard F., Jr., and F. Eugene Corriden. 1959. THE TOXICITY OF MALATHION TO KILLIFISH (CYPRINODONTIDAE) IN DELAWARE. Jour. Econ. Ent., Vol. 52, No. 4, pp. 696-700; Biological Abstracts, Vol. 34, No. 5, Abst. No. 12473. 1959.

A series of field tests was performed to ascertain the extent of malathion toxicity to killifish (Family Cyprinodontidae) inhabiting tidal marshes in Delaware. The technique involved placing 25 fish in metal tubs containing 7 gallons of habitat water. Each treated tub had an untreated control. In all, 304 killifish of the species Fundulus ocellaris were tested. Sprays were delivered by aerial application to simulate practical mosquito control procedure. Malathion was applied at 0.5 pound/acre. The fish were exposed to the oil solution for four hours, after which time they were examined and classed into normal, moribund, and dead. Five tests were performed; in the last three, the moribund individuals were placed in a recovery tub of fresh habitat water and inspected 20 and 64 hours later. According to the 4-hour results 26.3% died and 31.2% were unaffected, and 42.4% were sublethally poisoned. In four replicates the fate of the moribund fish was followed for 64 hours after treatment. Of these, 66% recovered while 26% died. Only 8% still were exhibiting symptoms at the end of the tests. There was no correlation between size of the fish and mortality. (Auth. abst.)

3088. Hodgkin, E. P. 1959. CATASTROPHIC DESTRUCTION OF THE LITTORAL FAUNA AND FLORA NEAR FREEMANTLE, JANUARY 1959. Western Australian Nat., Vol. 7, No. 1, pp. 6-11; Biological Abstracts, Vol. 34, No. 5, Abst. No. 12482. 1959.

Exceptionally low tides and attendant drought and high temperatures, resulted in catastrophic destruction of members of intertidal populations. Detailed or summary notes are given for most of the species in the affected populations. This large-scale "natural" experiment in population readjustment will be watched for many years to determine the length of time required to reestablish the previous associations. (W. B. C.)

3089. Timofeyev, M. P. 1958. ON THE METHOD OF COMPUTING THE TEMPERATURES OF WATER RESERVOIRS. (O METODIKE RASCHETA TEMPERATURY VODOYEMOV.) Meteorologiya i Gidrologiya 1958(12): 3-9; Biological Abstracts, Vol. 34, No. 5, Abst. No. 12498. 1959.

The temperature of the upper layer of waters

determines evaporation to a large extent, heat exchange with the air as well as with the deeper water layers. If there are no measurement results available it is necessary to determine the temperature mentioned indirectly for individual waters. Since in many cases measurement results are lacking, several methods of computing the temperature of the water surface are suggested. The present paper deals with the further development of these publications. For the ice-free period, the equation of the heat balance of the water surface may be expressed as follows: $R_1 = LE + P + Q$, where $R_1 = E_a - E_w$ denotes the reception of the long-wave radiation, E_a-atmospheric radiation, E_w-the radiation of the water surface, LE-the heat exchange connected with evaporation, P-heat exchange with the atmosphere, and Q-that with deeper water layers. After various computations the author obtains the final formula of computing the average temperature of the water surface: $\overline{T}_w = \overline{T}' + \frac{\overline{B}'}{\mu A} + \left[\frac{\mu o}{\mu} T_{ow} - \left(\overline{T} + \frac{\overline{B}'}{\mu A'}\right)\right] \frac{1-e^{-At}}{At}$. It can be seen from this formula that the average temperature of the surface of waters depends on the average temperature of the air above the mainland, on the received heat radiation, on the radiation characteristics of water, and on some meteorological factors of the mainland and the waters. Furthermore, the most extreme cases of formula are discussed: (a) a very short period of time t, low wind velocities and low air temperatures or very deep waters/formula; (b) shallow waters and high wind velocities/formula. The formulae reflect, in spite of their simplicity, certain rules which have been experimentally proved. This was confirmed by a detailed analysis. In conclusion the parameter μ(integral characteristics of heat exchange in water) is discussed more in detail. (OTS)

3090. Berzins, Bruno. 1958. A PLANKTONIC CROSS SECTION. (EIN PLANKTOLOGISCHES QUERPROFIL.) Rept. Inst. Freshwater Res. Drottningholm 39: 5-22; Biological Abstracts, Vol. 34, No. 5, Abst. No. 12502. 1959.

Zooplankton was collected with 51 cylinders on a transect of Skarshult Lake in South Sweden on August 7, 1950. The transect through the deepest portion (12 m) of the 36 hectare lake was only 145 long. All collections were made between 2 and 3:30 p.m. on a cloudless day. The epilimnion, to 4 m, was 17-20°C; the metalimnion was 3 m thick and the hypolomnion temperature was 9°C. Dissolved O_2 was almost lacking in the hypolimnion but was at 60-70% saturation in the upper metalimnion. The pH in the mesohumic lake was 6.3 to 6.7. Aquatic plants (Nuphar, Potamogeton natans, Myriophyllum alterniflorum) were abundant in the west end of the transect to a depth of 2 meters. Temperature, dissolved oxygen, and light intensity seemed to be the most important physical-chemical factors affecting the distribution of the zooplankton. Turbulence and currents in the epilimnion, and to a lesser extent in the metalimnion, from the wind were also important. Negative phototropism of the copepods and cladocerans affected their vertical distribution. Thermal and chemical stratification also had a pronounced effect. Only a few forms, such as Cyclops s. strenuus, were found in the hypolimnion. Among the rotifers, the 3 species of Collotheca, Trichocerca capucina, Gastropus stylifer and Polyarthra remata were found only in the epilmnion; Kellicottia longispina, Keratella c. cochlearis, and Polyarthra euryptera were found also in the upper metalimnion; Polyarthra major and Trichocerca similis extended throughout the metalimnion; and Polyarthra longiremis, Filinia longieseta and Keratella hiemalis were in the hypolimnion. (K. D. C.)

3091. Engelbrecht, R. S., and J. M. Morgan. 1959. STUDIES ON THE OCCURRENCE AND DEGRADATION OF CONDENSED PHOSPHATE IN SURFACE WATERS. Sewage and Indust. Wastes, Vol. 31, No. 4, pp. 458-478; Biological Abstracts, Vol. 34, No. 5, Abst. No. 12505. 1959.

Rate of hydrolytic degradation of polyphosphates in natural waters (introduced through extensive use of synthetic detergents) varies considerably at different locations on the same watershed, in different watersheds, and for different polyphosphates. Water filtration reduces the degradation rate, and associated bacteriological data suggests that the biological population is of significant importance. (I. G.)

3092. Goetz, Charles A., and Robert C. Smith. 1959. EVALUATION OF VARIOUS METHODS AND REAGENTS FOR TOTAL HARDNESS AND CALCIUM HARDNESS IN WATER. Iowa State Jour. Sci., Vol. 34, No. 1, pp. 81-112; Biological Abstracts, Vol. 34, No. 5, Abst. No. 12507. 1959.

Many new reagents and method modifications for hardness determinations have appeared recently. A critical study and evaluation of these reagents and methods has been performed with special emphasis upon the speed, accuracy, ease of end point detection, and applicability to various types of water samples. Stability of reagents and removal of interfering also were noted. The effect of varying pH upon accuracy of the various indicator end points was investigated. (Auth. abst.)

3093. Jacquemart, Serge, and Eugene Leloup. 1958. ECOLOGY OF AN OLIGOTROPHIC POND AND ADJACENT BIOTOPES. (ECOLOGIE D'UNE MORE OLIGOTROPHE ET DES BIOTOPES CONTIGUS.) (COLONSTER, PROVINCE DE LIEGE). Mem. Inst. Roy. Sci. Nat. Belgique 144: 1-50; Biological Abstracts, Vol. 34, No. 5, Abst. No. 12512. 1959.

A biocenotical study of a complex of pond, marshes and springs during an annual cycle (Nov. 1952-April 1954). Important and seasonal variations are bound with changes in external factors and biological cycles of species. In consequence of the slow eutrophication of the aquatic environment, the animal groupings are very stable. (From auth. summ.)

3094. Moretti, G., F. Gianotti, and C. Rossi. 1958. THE FLUCTUATIONS OF THE QUANTITY OF DISSOLVED OXYGEN IN THE PRE-APPENNINE REACHES

OF THE RIVER METAURO (PESARO, SOUTH ITALY.) (RITMI NICTEMERALI DELL'OSSIGENO DISCIOLTO NELLE ACQUE PREAPPENNINICHE DEL FIUME METAURO.) Atti. Soc. Ital.Sci. Nat., Vol. 97, No. 4, pp. 281-308; Biological Abstracts, Vol. 34, No. 5, Abst. No. 12515. 1959.

The long period fluctuations appear, from the measures made at dawn, mid-day, sunset and midnight once each month for 14 consecutive months, starting March, 1957, to be related to physical conditions, of temperature, barometric pressure, river discharge, speed of the current and transparency of the water. Differences found between the determinations made in the day and the ones at night are accounted for by considering the photosynthetic activity of the algae mantle covering the bed of the stream. (M. M.)

3095. Weiss, C. M. 1959. RESPONSE OF FISH TO SUB-LETHAL EXPOSURES OF ORGANIC PHOSPHORUS INSECTICIDES. Sewage and Indust. Wastes, Vol. 31, No. 5, pp. 580-593; Biological Abstracts, Vol. 34, No. 5, Abst. No. 12521. 1959.

Organic phosphorus compounds find widespread use as insecticides, and runoff into water bodies, therefore, may present hazards to aquatic life. A bioassay procedure is presented based on the cholinesterase inhibition, both in vivo and in vitro by these compounds. The procedure involves measuring acetylcholinesterase activity of excised fish brain tissue following exposure of the test fish to waters suspected or known to contain insecticides in question. Degree of inhibition was found to be a function of insecticide concentration, extent of exposure, and specific insecticide. Time required for enzyme activity recovery was dependent on initial inhibition, specific compound, and fish species. (I. G.)

3096. Zhuravel', P. A. 1958. ON ENRICHING THE FOOD SUPPLY FOR FISHES IN CRIMEAN RESERVOIRS. (OB OBOGASHCHENII KORMOVOY BAZY RYB VODOKHRANILISHCH KRYMA.) Dopovidi Akad. Nauk Ukrain. RSR 1958(4):456-458; Biological Abstracts, Vol. 34, No. 5, Abst. No. 12524. 1959.

All investigators of freshwater reservoirs of the Crimea, point out an underpopulation of fish and food fauna, which reduces the fish catch in these basins. The author's investigations show that favorable conditions have developed in the Crimean reservoirs for a number of faunal forms which are absent in the rivers feeding these reservoirs. Work on introducing fish species and food organisms into some Crimean reservoirs, initiated in the spring of 1955, already have yielded the first positive results. Chemical and hydrobiological studies of the reservoirs into which new species were introduced are being carried out. (OTS)

3097. Braekkan, Olaf R. 1959. A COMPARATIVE STUDY OF VITAMINS IN THE TRUNK MUSCLES OF FISHES. Fiskeridirekt. Skrifter Ser. Teknol. Undersøk., Vol. 3, No. 8, pp. 1-42; Biological Abstracts, Vol. 34, No. 5, Abst. No. 12710. 1959.

Fat, B-vitamins (except niacin) and enzyme activity were higher and protein lower in red than in ordinary muscle. The red muscle is believed to perform functions similar to those of the liver in the metabolism of the fish. Fishes, such as herring and tunny, that are very active, and whose muscles therefore need quick energy, have more red muscle than do the less active, such as flatfish. There was no relation between weight of cod and the vitamin content of the muscle. (R. P. E.)

3098. Graham, Jay E., and Russell D. Anderson. 1956/1957. TREATMENT OF A TROUT POND WITH HEPTACHLOR FOR THE CONTROL OF ANOPHELES FREEBORNI AITKEN LARVAE. Proc. Utah Acad. Sci., Arts and Letters 34: 81-82; Biological Abstracts, Vol. 34, No. 5, Abst. No. 14736. 1959.

The margins of a pond were treated with heptachlor (1 part to 30 million parts water). The mosquito larvae were practically all killed without injury to the trout. The treatment is not recommended until further data are available. (F. C. B.)

3099. Bauza Rullan, Juan. 1958. OTOLITHS OF PRESENT-DAY FISHES. (OTOLITOS DE PECES ACTUALES.) Bol. R. Soc. Espanola Hist. Nat. Biol., Vol. 56, No. 2, pp. 111-126; Biological Abstracts, Vol. 34, No. 5, Abst. No. 14884. 1959.

Descriptions and measurements are given for otoliths of Psettodus erumei, Eucitharus linguatula, 4 spp. of Arnoglossus, Bothus podas, Zeugopterus punctatus, and Alosa fallax.

3100. Hickling, C. F. 1959. SOME MARKING EXPERIMENTS WITH THE TILAPIA FISH. Malayan Agric. Jour., Vol. 42, No. 1, pp. 21-30; Biological Abstracts, Vol. 34, No. 5, Abst. No. 14887. 1959.

To determine growth rate of Tilapia mossambica fin cutting was studied as a method of marking. Mortality rate was increased and there apparently was some regeneration of fins. Hence, yellow plastic labels were attached to the dorsal fin as a means of identification. Under relatively natural conditions females obtained a weight of about 225 gm and a length of 24 cm in 200 days. Male fish of a closely related species, from East Africa, did not grow as rapidly as the Malayan species but the reverse was true with females. Hybrids between the Malayan and African types were more vigorous, growing twice as rapidly as either parent stock. (W. F. J.)

3101. Schlicht, Frank G. 1959. FIRST RECORD OF THE MOUNTAIN MULLET, AGONOSTOMUS MONTICOLA (BANCROFT) IN TEXAS. Texas Jour. Sci., Vol. 11, No. 2, pp. 181-182; Biological Abstracts, Vol. 34, No . 5, Abst. No. 14895. 1959.

Two specimens of A. monticola were taken on the coast of Texas during the summer of 1958. One, 29 mm standard length was taken at Port Aransas and

the other, 36 mm standard length was taken in shallow surf at Rollover Pass near Galveston, Texas. (Auth.)

3102. Jackson, Harry O., and William C. Starrett. 1959. TURBIDITY AND SEDIMENTATION AT LAKE CHAUTAUQUA, ILLINOIS. The Journal of Wildlife Management, Vol. 23, No. 2, pp. 157-168.

At Lake Chautauqua, Mason County, Illinois, between 1953 and 1957, 346 turbidity determinations were made with a Jackson turbidimeter and 156 water-transparency readings were taken with a Secchi disk. Turbidity of the lake ranged from less than 25 p.p.m. to 800 p.p.m. The resuspension of sediment particles, which were originally carried and deposited in the lake by flood waters of the Illinois River, caused the high turbidities at Lake Chautauqua. The disturbance of the lake bottom by fish and/or water motion produced by wind caused sediment particles to become resuspended. Wind velocity had little or no effect upon turbidity when vegetation or ice cover was present in the lake or in areas where depth of the water exceeded about 5.8 feet. When depths of the lake were less than 4.8 feet and vegetation or ice cover was absent, turbidity tended to vary with wind velocity. During periods when wind had little or no effect upon turbidity, fish activity and to a lesser extent phytoplankton usually prevented the lake from becoming clear. Over an 8-year period, the removal of 2,022,965 pounds of fish from the lake by commercial fishermen had no apparent effect upon vegetation growth or turbidity. During moderately high river stages, turbidity was affected only in areas where the river water was overflowing into the lake. Important duck-food plants that were formerly abundant were adversely affected by sedimentation and fluctuating water levels. Changes had also occurred in the species composition of the fishes. The shallowness of Lake Chautauqua through much of the growing season assured that most of the lake was within the euphotic zone, and this was considered to be an important factor in the high productivity of this turbid, fertile lake. (Auth summ.)

3103. McCrimmon, Hugh R. 1959. OBSERVATIONS ON SPAWNING OF BURBOT IN LAKE SIMCOE, ONTARIO. The Journal of Wildlife Management, Vol. 23, No. 4, pp. 447-449.

A study was carried out between 1954 and 1957 to determine the spawning habits of the burbot (Lota lota lacustric) in Lake Simcoe. It was found that winter runs of burbot into the tributary rivers were for the purpose of feeding rather than for spawning as previously supposed. These runs occurred largely in the postspawning period. The investigation was then transferred to the open lake. Upon locating a shoal on which burbot spawned, observations were made on the nature of the spawning bed and upon spawning characteristics.

Mature burbot arriving at the shoal after mid-January spawned in late January and early February. The majority of these fish had left the shoal by mid-February. By this time numbers of yellow perch, common sucker, and whitefish frequented the area.

In the hatchery, burbot eggs hatched in mid-April. Adult fish did not feed during the spawning period but began to prey heavily on forage fish in the lake and tributary rivers immediately after spawning. (Auth. summ.)

3104. Hepher, B. 1959. CHEMICAL FLUCTUATIONS OF THE WATER OF FERTILIZED AND UNFERTILIZED FISHPONDS IN A SUBTROPICAL CLIMATE. Bamidgeh, Vol. 11, No. 1, pp. 3-22.

The results of the experiments carried out for the purpose of the present study may be summarized as follows:

(a) In unfertilized fish ponds carbon dioxide concentration is lower than at the water source. Due to the relatively low intensity of biological processes the diurnal fluctuation of carbon dioxide, as well as alkalinity, oxygen, and pH is low. Fluctuation increases to some extent in summer which is warmer, when there is an increase in photosynthetic and respiratory activity.

(b) Calcium concentration is high at the water source, reaching 93.6-96.7 mg./l. Ca, but decreases in unfertilized ponds to only about 50 mg./l. Ca.

(c) Phosphorus concentration, which is low at the water source, not exceeding 0.017 mg./l. P, shows no marked fluctuation in unfertilized ponds. In some instances a sudden increase in phosphorus concentration occurs, which may be attributed to the decomposition of plankton due to changes in the nature of the plankton population in the pond. It appears that this is a result of sudden changes in the living conditions in the water.

(d) Nitrogen concentration, which is relatively high at the water source - about 2 mg./l. N, decreases on introduction into unfertilized ponds, maintaining a more or less constant level. The rate of nitrogen decrease and the final level attained vary for different growing seasons. In spring the decrease is relatively slow, the final level after 60 days being about 0.6 - 0.9 mg./l. N. In summer the rate of decrease is more rapid, and the final level after 30 - 40 days is lower - about 0.3 - 0.5 mg./l. N. In autumn too the rate of decrease is rapid due to the temperatures which are still high at the onset of the season, but the final level is similar to that of spring because of the lower temperatures at the end of the season.

(e) No decrease in the potassium concentration was noted in the pond water. The uptake or fixation of potassium which is apt to occur is probably compensated by the addition of potassium rich water from the water source. (10.8 mg./l. K).

(f) Chemical changes in the fertilized ponds were much more pronounced as a result of the higher intensity of biological processes in the water of these ponds.

(g) Diurnal fluctuations in oxygen concentration and pH are more pronounced in the fertilized than in the unfertilized ponds and become much stronger with the rise in temperature during summer months. The oxygen concentrations reach maximum values of 18.0 -

19.2 mg. /l, O_2 and minimum values of 0.0 mg. /l. which may cause mortality of fish due to deoxygenation. The fluctuation in carbon dioxide concentration and alkalinity in the fertilized ponds is also more pronounced than in unfertilized ponds.

(h) Calcium concentration during the winter months decreases similarly in fertilized and unfertilized ponds. In summer months, however, it increases considerably and in the fishponds fertilized weekly reaches a concentration of 190 mg. /l. Ca after 190 days.

(i) In ponds fertilized with phosphorus only, the decrease in nitrogen concentration was much more rapid than in the unfertilized ponds.

(j) In ponds fertilized with phosphorus and nitrogen the decrease in concentration of these minerals was very rapid, and 13 days after fertilizing, the minerals added could not be detected in the water. A distinct difference in the rate of concentration decrease of the added minerals was observed at different growing seasons. This rate rose more in summer than in spring and autumn.

In summer the added phosphorus disappeared within 41 hours after being introduced and the concentration of nitrogen found in the water after the same period was much lower than that added to the water.

The concentration of phosphorus and nitrogen in ponds fertilized weekly was in general lower than that found in fishponds fertilized fortnightly for the corresponding period. (Auth. summ.)

3105. Shuster, Carl N., Jr. 1959. A BIOLOGICAL EVALUATION OF THE DELAWARE RIVER ESTUARY. Information Series, Publication Number 3, University of Delaware Marine Laboratories, 77 pgs.

Subjects listed in the table of contents include: The University of Delaware Marine Program; Morphometry of Delaware Bay; Extent of the Delaware River Estuary; Role of Tidemarshes in Estuarine Production; Shore Zone Fishes of Delaware Bay; Comments on the Ecology of Estuarine Invertebrates; Evaluation of the Delaware River Estuary Fisheries; and Hypothesis on Tidemarsh Productivity.

3106. Larsen, Knud. 1949. FIRST REPORT ON THE EFFECT OF THE LIBERATION OF SALMON FRY IN THE GUDENAA 1946-47. Report of the Danish Biological Station. XLIX, 1946, pp. 29-38.

Compared with the results of similar experiments in the Kavlingea the experiments described have hitherto shown

i. that the liberation of salmon fry in smaller water-courses ad modo Otterstrom increases the stock of 1-summer-salmon in the streams,

ii. that we get the greatest increase of the stock of 1-summer-salmon by the smallest population of stationary trout, and

iii. that the parr in the course of about 1 year emigrate from the smaller streams thus leaving favourable conditions for the fry liberated next year.

For further investigations of this kind - also concerning the fry of sea trout - it would be of great help to get one or a few small streams for experimental purposes and to get an apparatus for electric fishing, so that this important part of the work of restoring the stocks of salmon and trout can be continued independently of the possibility of borrowing such apparatuses from abroad and of the time at which they can be had. (Auth. summ.)

3107. Czapik, A. 1957. INFLUENCE OF FERTILIZATION OF PONDS ON THE DEVELOPMENT OF THE ZOOPLANKTON. Biul. Polska Akad. Nauk, 1957, No. 5, 71-96 (German summary 96); Water Pollution Abstracts, Vol. 32, No. 10, Abst. No. 1822. 1959.

In fertilized and unfertilized ponds at Ochaby, 29 types of Rotatoria and 17 types of Cladocera were found. The types of Rotatoria were the same in both fertilized and unfertilized ponds. In the case of Keratella cochlearis, individuals from fertilized ponds were somewhat bigger than those from unfertilized ponds, but the difference was slight. The development of Cladocerans followed the content of nutrient matter in the ponds, larger forms (Daphnia) developing at the beginning of the summer and smaller forms (Bosmina and Ceriodaphnia) later, with decrease in nutrient matter. Nutrient matter appeared in general to be exhausted in the course of the production period. Daphnia appeared slightly earlier and in somewhat larger numbers in fertilized than in unfertilized ponds.

3108. Vernon, E. H. 1958. AN EXAMINATION OF FACTORS AFFECTING ABUNDANCE OF PINK SALMON IN THE FRASER RIVER. Progr. Rep. int. Pacif. Salm. Fish. Comm., 1958. 52 pp.; Water Pollution Abstracts, Vol. 32, No. 10, Abst. No. 1827. 1959.

As indicated by catch data, large fluctuations occurred in the abundance of pink salmon in the Fraser river, B. C., in the period 1935-1957; and from an analysis of the factors affecting the abundance of the adult fish, it is concluded that, in addition to the temperature and stream flow in the river itself, the temperature and salinity of the marine environment (Georgia Strait) during early life are also very important.

3109. Anonymous. 1958. 10TH ANNUAL SUMMARY, 1958. Ohio River Valley Water Sanitation Commission. 32 pgs.; Water Pollution Abstracts, Vol. 32, No. 10, Abst. No. 1930. 1959.

The 10th annual report of the Ohio River Valley Sanitation Commission includes a summary of the achievements over the past ten years, and details of work in progress relating to proposals for the control of trade effluents (especially chloride content, tastes and odours, oil, mine-drainage water, and toxic substances) and of municipal sewage effluents (especially those discharged to the Monongahela river); regular sampling of the Ohio river and its tributaries; determination of radioactivity;

survey of aquatic life, particularly fish; identification of substances causing tastes and odours; and the use of membrane filters to measure bacteriological quality. A summary is also given of the work of the various Advisory Committees. During the year, the coliform bacterial count in the river (an index of sewage pollution) and phenolic tastes and odours decreased; and the dissolved mineral content and algal growth increased; radioactivity was well below the health tolerance limit. A diagram of the river is included showing the positions of water intakes (industrial and municipal) and points of discharge of used water. Sewage-treatment facilities are now in operation or under construction to serve 79 per cent of the total sewered population; and 54 per cent of the industries discharging effluents to the rivers are provided with satisfactory control facilities. Lists of sewage works completed, improved, or under construction during the year are included.

3110. Weber, E. 1957. TOXICOLOGICAL INVESTIGATIONS ON WATER ORGANISMS. Wass. u. Abwass., 12 pp.; Water Pollution Abstracts, Vol. 32, No. 10, Abst. No. 1935. 1959.

The author describes methods of carrying out toxicological experiments on fish and other water animals, with special reference to maintenance of constant temperature, aeration, and choice of test animals. For experiments in streams the Bundesanstalt fur Wasserbiologie und Abwasserforschung uses a wooden trough with a glass cover and closed at both ends with gratings; this is immersed in the stream and stocked with fish. The author then describes, from the literature and from experiments made by the Bundesanstalt, the effects of a number of substances on fish and other water animals, giving the symptoms of poisoning, the limits of toxicity, and the effects of temperature, hardness, and pH value. Substances dealt with are cyanide, phenol, metals, dyestuffs, organic matter, ammonia, synthetic detergents, hydrogen sulphide, and chlorine. References to the literature are given.

3111. Chlorator, G. M. B. H., and R. Kroke. 1957. CONTROL OF DISSOLVED OXYGEN IN WATER. G. P. 951, 894; Chem. Zbl., 1957, 128, 10846; Water Pollution Abstracts, Vol. 32, No. 11, Abst. No. 1993. 1959.

The concentration of dissolved oxygen in water is controlled by using an electrochemical determination apparatus by which, with an electrode pair in the flowing water before measuring cell of the apparatus, electrolytic oxygen is produced, cathode products, for example hydrogen, being discharged.

3112. Otto W. 1957. THE CAUSE OF WEED GROWTH IN THE IMPOUNDING RESERVOIR ROTHA-PLEISSE. Wasserw.-Wass Techn., 1957, 7, 454-455; Water Pollution Abstracts, Vol. 32, No. 11, Abst. No. 2009. 1959.

Shallow water and strong sunlight caused excessive development of submerged plants in the impounding reservoir at Rotha, which was built to improve the very polluted waters of the Pleisse. Accumulations of sludge formed, the oxygen content was greatly reduced, contents of ammonia, chlorine, and lime increased, and hydrogen sulphide was present. Trouble was caused by blocking of screens in the works of various industries taking their supply from the reservoir. Investigation showed that a high content of lime encouraged development of hornweed (Ceratophyllum demersum) which was the main growth in the reservoir. The author proposes that steps should be taken to reduce the lime content in the entering water.

3113. Mrozinska, T. 1957. MAT-LIKE ACCUMULATIONS OF ALGAE IN THE OCHABY FISHPONDS OF THE EXPERIMENTAL STATION FOR BIOLOGY OF PONDS OF THE POLISH ACADEMY OF SCIENCE, CRACOW. Biul. Polska Akad. Nauk, 1957, No. 4, 99-109 (German summary 108-109); Water Pollution Abstracts, Vol. 32, No. 11, Abst. No. 2010. 1959.

The development of filamentous algae in fishponds was observed from May to October 1954. In spring a few accumulations formed near the banks; in summer there was intensive development both near the banks and in the central parts; in September there was a slight decrease in some ponds and complete disappearance in others and this condition continued until October when the ponds were emptied. The types of algae which varied with the season, and the epiphytic organisms present are described. Most of the organisms were of types common in Poland but a few forms not previously found in Polish waters were noted.

3114. Albrecht, M. L., and E. M. Bursche. 1957. FISHERY BIOLOGICAL INVESTIGATIONS IN FLOWING WATERS. I. PHYSIOGRAPHIC-BIOLOGICAL STUDIES ON THE POLENZ. Z. Fisch., 1957, 4, (N. F.), 209-240; Water Pollution Abstracts, Vol. 32, No. 11, Abst. No. 2015. 1959.

The authors describe investigations on a 6-km stretch of the Polenz. In the upper part of the stretch trout are present and in the lower part grayling. The geography and morphology of the district and the flow, gradient, and chemical condition of the river are described. The methods of quantitative and qualitative biological examination are described and the results of the investigation are given in tables. Pollution of the stream by domestic sewage is shown by the appearance of a- to β-mesosaprobic organisms. 5 km below the last sewage outlet self-purification had restored the water to its normal oligosaprobic to β-mesosaprobic condition.

3115. Vallin S. 1958. INFLUENCE OF WASTE WATERS OF THE WOOD INDUSTRY ON STREAMS. Verh. int. Ver. Limnol., 1958, 13, 463-473; Water Pollution Abstracts, Vol. 32, No. 11, Abst. No. 2098. 1959.

Figures are given showing the development of the cellulose and paper industries since 1920 in Finland, Norway, and Sweden. The specially harmful effects of waste waters from the manufacture of sulphite

cellulose are described and an account is given of chemical and biological conditions in a stream heavily polluted with such wastes. Production of alcohol from the lye does not greatly reduce the polluting effect as the remaining vinasse contains much organic matter. Experiments on oxygen consumption by fibre, sulphite lye, and sulphite vinasse showed that oxygen consumption began more quickly and proceeded more rapidly in vinasse than in the acid lye; the B. O. D. of the lye was reduced by 40-50 per cent by recovery of alcohol. The acid lye caused vigorous fungal growth but after alcohol recovery this was replaced by diatoms. When alcohol recovery was given up and the old lye concentration plant was replaced by a modern plant, pollution of the stream increased, causing low pH values, growth of fungus, oxygen deficiency, and death of fish in the stream and a lake for a long distance below the factory. A combination of alcohol production, concentration, and incineration, as used in several Swedish factories, is recommended. Waste waters from sulphate cellulose factories contain less organic matter than those from sulphite cellulose processes. Most of the sulphate cellulose waste waters are incinerated for recovery of chemicals and only about 6-8 per cent are discharged with washing waters. The wastes colour the stream and cause formation of a very resistent foam; they are more poisonous, especially to fish, than sulphite wastes, and affect the taste of fish when the concentration is lower than the toxic limit. Brief accounts are also given of the effects of waste waters from the fibre-board, semi-chemical cellulose, and paper industries, and experiences on the effects of sulphite cellulose waste waters on a number of Swedish lakes are described.

3116. Liebmann, H. 1959. THE TOXICITY TO FISH OF WASTE WATERS FROM THE COAL AND IRON INDUSTRIES. Arb. Dtsch. Fischerei-Verbandes, 1959, No. 11, 3-6; Water Pollution Abstracts, Vol. 32, No. 11, Abst. No. 2145. 1959.

Waste waters from the coal and iron industries are of special importance for the river Mosel which receives heavy pollution from the Saarland and Lothringia. The types of waste water produced by these two industries are described and the author then deals, from the literature, with the effects on fish and other water organisms of phenols and cyanide, giving the symptoms of poisoning, the toxic limits, and the effect on toxicity of various conditions in the water, such as temperature, content of oxygen, presence of other toxic substances, and hardness.

3117. Macklin, M. O., D. J. Baumgartner, and M. B. Ettinger. 1959. PERFORMANCE TEST OF CONTINUOUS RECORDING DISSOLVED OXYGEN ANALYSER. Sewage industr. Wastes, 1959, 31, 804-810; Water Pollution Abstracts, Vol. 32, No. 12, Abst. No. 2234. 1959.

An instrument for the continuous analysis of dissolved oxygen in water has been developed, based on theories established in earlier work. The method involves establishing a Henry's law equilibrium between a flowing water sample and the concentration of oxygen in a gas at constant pressure and volume. The instrument has given reasonably good results in laboratory and field tests under various water conditions at different concentrations of dissolved oxygen. Results obtained were accurate within $\pm$ 5 per cent of the saturation value as determined by the Winkler method. Only a few difficulties were encountered due to clogging, frothing, and leaks, and the design of future models will be altered to overcome these difficulties.

3118. Macan, T. T. 1958. THE TEMPERATURE OF A SMALL STONY STREAM. Hydrobiologia, 1958, 12, 89-106; Water Pollution Abstracts, Vol. 32, No. 12, Abst. No. 2247. 1959.

The temperature in a small stream in the Lake District was recorded with a thermograph over a period of five years. It was found that the highest temperatures were reached, not in dry spells when the water level was low, but when the sun shone strongly after rain. When the stream passed through an artificial underground channel the temperature dropped; a similar effect was observed in another stream flowing through a wood. Greater fluctuations in temperature were observed lower down the stream. It is concluded that small streams warm rapidly and reach equilibrium a few km from the source, the average water temperature being not very different from the average air temperature.

3119. Khachidze, S. G. 1956. ACCIDENTAL POISONING OF FISH IN THE RIVER KURA. Hyg. & Sanit., Moscow, 1956, 21, No. 11, 69-70; Water Pollution Abstracts, Vol. 32, No. 12, Abst. No. 2337. 1959.

The death of all fish within 40 km of an industrial plant after the discharge of waste waters with a high concentration of phenol into the river Kura, U. S. S. R., is reported. The plant effluent, which contained 77 mg per litre of phenol, formed a thick film over the surface of the river. The concentration of phenol in the dead fish was found to be between 0. 1 and 6. 3 mg per kg of body weight. The next day the river water downstream from the factory outlet contained only 0. 55 mg per litre of phenol, and at a distance of 100 km, no phenol was detected.

3120. Wiesner. 1958. FISH POISONING BY AMMONIACAL BREWERY EFFLUENTS. Brauwelt, 1958, 98, B, 862; Water Pollution Abstracts, Vol. 32, No. 12, Abst. No. 2339. 1959.

Several cases of fish mortality have occurred as a result of discharge of ammoniacal wastes during repairs or renewals of cooling plant at breweries. Data confirming the toxicity of ammonia to fish are given.

3121. Coopey, R. W. THE ACCUMULATION OF RADIOACTIVITY AS SHOWN BY A LIMNOLOGICAL STUDY OF THE COLUMBIA RIVER IN THE VICINITY OF HANFORD WORKS. HW-11662, Office of Technical Services, U. S. Dept. Commerce, Washington,

D. C., 1952, 14 pp.; Water Pollution Abstracts, Vol. 32, No. 12, Abst. No. 2346. 1959.

The radioactivity present in the bottom fauna of the Columbia river due to the discharge of radioactive waste waters from the Hanford Works, Richland Wash., was investigated at 9 stations in the vicinity of the plant, from November 1947 to April 1948. The approximate activity accumulated by a variety of organisms in diluted waste water, as in the river, or in higher concentrations of the effluent under laboratory conditions, was determined. Data are tabulated. There was considerable variation in the concentration of radioactivity found; in some insect larvae and Crustacea, it was high. A list is included of common plankton genera present in the river.

3122. Clukey, H. V. 1957. THE HANFORD ATOMIC PROJECT AND COLUMBIA RIVER POLLUTION. HW-54243 (Rev.). Office of Technical Services, U. S. Dept. Commerce, Washington, D. C., 1957, 21 pp.; Water Pollution Abstracts, Vol. 32, No. 12, Abst. No. 2347. 1959.

Since the reactors at the Hanford works, Wash., were put in operation in 1944, the amount of radioactive material discharged to the Columbia River has increased. However in 1957 the amount of radioactivity discharged to the river was only a few per cent of the maximum permissible concentration. Heating of the river by the Hanford effluents is not likely to be harmful to fish. Hexavalent chromium is the only chemical occurring in a significant concentration, and this is less than the recommended limit of 0.02 p.p.m. for Columbia River fish. Field studies indicate no detrimental effects on biota in the river caused by the effluents. Biological pollution is controlled by proper treatment of sewage from the plant before discharge.

3123. Herde, K. E. 1957. A ONE-YEAR STUDY OF RADIOACTIVITY IN COLUMBIA RIVER FISH. HW-11344, Office of Technical Services, U. S. Dept. of Commerce, Washington, D. C., 1957, 11 pp.; Water Pollution Abstracts, Vol. 32, No. 12, Abst. No. 2348. 1959.

A survey was carried out on fish collected from the Columbia River between April 1947 and April 1948, to determine their radioactivity. Results are given of the beta activity of 194 fish. Samples of algae were collected at the same time, and were assayed for radioactivity. Procedures and results are discussed.

3124. Olson, P. A. 1958. SOME EFFECTS OF PILE AREA EFFLUENT WATER ON YOUNG SILVER SALMON. HW-8944, Office of Technical Services, U. S. Dept. Commerce, Washington, D. C. 1958, 21 pp.; Water Pollution Abstracts, Vol. 32, No. 12, Abst. No. 2349, 1959.

A study was made of the effects of radioactive waste waters from atomic piles of the Hanford Works, Richland, Wash., on the mortality and development of silver salmon eggs, fry, and fingerlings. Data are tabulated for various concentrations of effluent in Columbia River water.

3125. Herde, K. E. 1957. STUDIES IN THE ACCUMULATION OF RADIOACTIVE ELEMENTS IN ONCORHYNCHUS TSCHAWYTSCHA (CHINOOK SALMON) EXPOSED TO A MEDIUM OF PILE EFFLUENT WATER. U. S. Atom. Energ. Comm., HW-3-5064, 21 pp.; Water Pollution Abstracts, Vol. 32, No. 12, Abst. No. 2350. 1959.

Investigations were carried out to determine the total accumulation of radioactive elements in fish exposed to cooling water from a nuclear reactor. Data are reported on the accumulation of sodium-24 and other longer-lived elements in the fish, including the rate of accumulation of radioactive materials during controlled exposure for various periods, the effect of temperature on the rate of accumulation, evidence of accumulation of varied amounts of longer-lived materials, the significance of the excretion factor when fish containing sodium-24 are removed to fresh water, and individual variations in fish regarding their metabolism buffer ability or tolerance to radioactive materials.

3126. Huiswaard, P. J., R. B. Banks, and C. G. Bell. 1959. DISPERSION IN TIDAL ESTUARIES. AECU-4037, Office of Technical Services, U. S. Dept. Commerce, Washington, D. C., 1959, 103 pp.; Water Pollution Abstracts, Vol. 32, No. 12, Abst. No. 2353, 1959.

Experiments were carried out at Northwestern University, Evanston, Ill., with methylene blue tracer, to study the influence of the diffusion process of the periodic variations in flow which are characteristic of tidal estuaries. The oscillation of polluting matter was also studied in a model of Savannah harbour by injection of radioactive tritium water.

3127. Bieliukas, K. 1958. LIMNOLOGICAL INVESTIGATIONS IN LITHUANIA AND THE MAIN PROBLEMS OF THE IMMEDIATE FUTURE. Lietuvos TSR Geografine Draugija, Geografinis Metrastis, 1 t., 1958. 16 pgs.

The author outlines the history of the limnological investigations in which three periods are distinguished: 1861-1918; 1918-1940; and 1940-1958. The complex research of the Lithuanian lakes on large scale begun only after the second World War. It was carried out by the geographers of the Lithuanian Academy of Sciences together with the limnologists of the Lithuanian State University in Vilnius. Recently the catalogue of the Lithuanian lakes with the map 1:300 000 has been completed. It was found, that in the territory of Lithuania, approximately, there are 4000 lakes with a total area of 94,600 ha. The largest of the Lithuanian lakes is the Druksiai lake (4500 ha), the deepest one the Tauragnai lake (60,5 m).

In the article actual questions of Lithuanian limnology and the ways of lake research in the next future are pointed out.

3128. Bieliukas, K. 1958. MATHEMATICAL BASIS OF SOME INDICATORS IN LAKE MORPHOM-

ETRY. Lietuvos TSR Geografine Draugija, Geografinis Metrastis, 1 t., 1958, 45 pgs.

The question of indicators used in lake morphometry became very actual in Lithuania in connection with the fact that the limnological investigations have made and make a great progress every year. The author throws light on the main morphometric indicators from the standpoint of mathematics and discusses the possibilities of their application.

For practical reasons the indicators are subdivided into six categories concerning: 1) lake surroundings, 2) water table, 3) capacity, 4) shape of lake-vessel, 5) bottom, 6) water body.

3129. Bunikis, A. 1959. THE MINERAL CONSTITUENTS: PHYSICAL AND BIOLOGICAL ASPECTS OF PLATELIU LAKE, LITHUANIA. Lietuvos TSR Mokslu Akademijos Darbai, Serija B, 2(18), 1959, 11 pgs.

Lake Plateliu is located in the Samogitian highlands. The temperatures and the results of chemical analysis are listed in four tables. O_2, CO_2 in mg/l and the pH are listed for the seasonal fluctuations at various depths. The anions HCO_3^-, $CO_3^=$, $SO_4^=$, Cl^- and the cations Ca^{++}, Mg^{++}, Na^+, K^+ are also similarly listed. The lake belongs to the carbonate class and the calcium group. (V. A. A.)

3130. Bunikis, A. 1959. THE CHEMICAL CHARACTERISTICS OF THE ILGIO, TAUSALO AND PLINKSIU LAKES, LITHUANIA. Lietuvos TSR Mokslu Akademijos Darbai, Serija B, 3(19), 1959, 16 pgs.

All the lakes are located in the Samogitian highlands. The complete chemical analysis is listed. The temperature, color, plankton, and the entering streams are discussed. They are listed in detail according to the spring, summer, and fall seasons. Two lakes had a satisfactory O_2 content and a pH 7.1-8.4. The largest amount of ions present are $HCO_3^=$ and Ca^{++}. Tausalo Lake is expanding into a peat bog resulting in a deleterious effect on the water. (V. A. A.)

3131. Bieliukas, K., and V. Chomskis. 1959. FUNDAMENTAL FACTS CONCERNING THE MOVEMENT OF STRATIFIED AQUEOUS LAYERS IN LAKE WATERS. Lietuvos TSR Geografine Draugija, Geografinis Metrastis, II t., 1959, 45 pgs.

This monograph discusses the effects of the temperature, mineral contents, and biological phenomena in the circulation of waters in lakes. The mathematical treatment is given throughout and some aspects of colloid chemistry and physics are discussed. (V. A. A.)

3132. Cervinskas, E. 1959. THE INTERCHANGE OF WATER BETWEEN THE BALTIC SEA AND THE COURISH LAGOON. Lietuvos TSR Geografine Draugija, Geografinis Metrastis, II t., 1959, 51 pgs.

Very detailed discussion of the effects of meteoroligical and geological factors causing currents near the Lithuanian seacoast. (V. A. A.)

3133. Macevicius, J. 1959. FLUCTUATIONS IN THE ANNUAL RUNOFF OF LITHUANIAN RIVERS. Lietuvos TSR Geografine Draugija, Geografinis Metrastis, II t., 1959, 13 pgs.

Discussion of meteorological and geographical factors influencing the annual levels of rivers in Lithuania. (V. A. A.)

3134. Macevicius, J. 1959. INVESTIGATING LITHUANIAN RIVERS AND THE IMMEDIATE OBJECTIVES. Lietuvos TSR Geografine Draugija, Geografinis Metrastis, II t., 1959, 22 pgs.

A short history of accomplishments from 1553 is given. Also future plans are outlined for the further study of Lithuanian rivers. A good bibliography of research work is given. (V. A. A.)

3135. Dowell, Virgil E., and Carl D. Riggs. 1958. FURTHER OBSERVATIONS ON ASTYANAX FASCIATIS AND MENIDIA AUDENS IN LAKE TEXOMA. Proceedings of the Oklahoma Academy of Science for 1955, pp. 52-53.

Astyanax fasciatus mexicanus, Mexican banded tetra. The first known specimen of Astyanax from Lake Texoma was taken by Riggs in 1953. Up to the present time we have taken 49 Astyanax from Lake Texoma without any special effort to collect this species. It is not probable that sufficient numbers of Astyanax would have escaped or have been discarded from fishermen's bait buckets to establish a population of sufficient size to provide the 49 specimens in our collections. This, along with the occurrence of small, young-of-year fish, strongly indicates that reproduction is occurring in the lake, and that there is some survival throughout the winter.

Menidia audens, Mississippi silversides. Our collections of 1955 indicate that the population of this species within the lake is increasing, and at the same time, that the population of the brook silversides, Labidesthes sicculus, is decreasing.

If the present trend of population change continues, it appears that Labidesthes will be confined to the tributary streams upstream from the upper limits of inundation, and that Menidia will completely take over the areas of the main body of the lake previously occupied by Labidesthes. It is possible, of course, that this sudden population change is only temporary.

3136. van Haagen, Richard H., and Harry P. Dale. 1959. FISHERIES INSTRUMENTATION LABORATORY OFFERS BIOLOGISTS NEW RESEARCH "TOOLS." U. S. Department of the Interior, Fish and Wildlife Service Commercial Fisheries Review, Sep. No. 546, pp. 27-31.

A new and unique unit, the Fisheries Instrumentation Laboratory of the U. S. Bureau of Commercial Fisheries, has been established in Seattle, Wash., to assist fishery workers in making the most effective use of modern instrumentation and other physical science devices for their research problems. Services of the staff of the Fisheries Instrumentation

Laboratory are available to all personnel of state, Federal, and private agencies who are contributing towards the advancement of fishery research and management.

Several examples of modern instrumentation applied to fishery research are: (1) Pulsating direct current applied between the hand-held positive electrode and the metal hull of the skiff tend to attract and momentarily stun the fish in the vicinity of the positive electrode; (2) an automatic high-speed tagged herring ejector; (3) an improved self-contained current recorder; (4) a battery-powered intervalometer; (5) a mechanical treadle-operated tag injector; (6) a mechanical half-meter measuring device; (7) a combination optical and electronic device for the purpose of accurate, rapid, and semi-automatic salmon-scale reading; (8) a Gulf II plankton sampler; and (9) a portable crab measuring instrument.

3137. Riggs, Carl D., and Virgil E. Dowell. 1956. SOME RECENT CHANGES IN THE FISH FAUNA OF LAKE TEXOMA. Proceedings of the Oklahoma Academy of Science, Vol. 35--1954, pp. 37-39.

The change in abundance of several species of fish in Lake Texoma is given. Causes for changes in abundance are listed for several of these species.

3138. Dale, Harry P. 1959. ELECTRONIC FISHING WITH UNDERWATER PULSES. Electronics, Vol. 32, No. 4.

This paper describes the design (electrodes, circuits, current formula, control circuit, trigger, and power) of an interrupted d-c fish-shocker which is lightweight and portable.

3139. Schumacher, Robert E. 1958. DUSCHE CREEK CREEL CENSUS - POPULATION STUDY FOR 1954-1955. Minnesota Fish and Game Investigations, Fish Series Number 1, Minnesota Department of Conservation, Division of Game and Fish, Bureau of Research and Planning, pp. 1-25.

The feasibility of providing angling with rainbow trout stocked in streams from which they could migrate was tested on Dusche Creek in Southeastern Minnesota. It was sought to determine whether yearling rainbows stocked in a marginal but heavily fished trout stream would be caught in sufficient numbers prior to this migration to warrant their use as a substitute for the less readily caught brown trout in a portion of the stocking quota. Observations were made on the return to anglers of two different years of stocking, including both fall and spring stocked brown and rainbow trout. All stocked fish were suitably marked for later identification.

Anglers in 1954 took 23.6 percent of the brown and 21.6 percent of the rainbows stocked in the spring of that year. In 1955 they caught 51.4 percent of the brown and 46.9 percent of rainbow trout stocked in the fall of 1954. This was 77.4 and 100 percent respectively of the brown and rainbow trout left in the stream at the beginning of the season following the fall plant. Of the fish stocked in the spring of 1955, 68.3 percent of the browns and 82.9 percent of the rainbows were caught.

Population estimates by electric seine in the spring revealed an over-winter survival of fall stocked 18 month old trout to be 70 percent of the browns and 55.5 percent of the rainbows. Eighty-five percent of the fall stocked browns and 84 percent of the fall stocked rainbows that were caught the next season were taken in the first week of the season. Spring stocked brown and rainbows did not yield 85 percent of the total harvest until 31 and 27 days, respectively, after the season opened. (Auth. abst.)

3140. Scheftel, Zane. 1958. AN ECONOMIC EVALUATION OF THE SPORT FISHERY OF MINNESOTA - PART ONE. Minnesota Fish and Game Investigations, Fish Series Number 1, Minnesota Department of Conservation, Division of Game and Fish, Bureau of Research and Planning, pp. 26-34.

As determined from questionnaires returned by 1024 non-resident anglers in a carefully planned mail census, the average non-resident angler spent $96.86 in Minnesota in 1956 for services and items chargeable to fishing. Average length of time spent in the state was 9.5 days. On this basis it was estimated that total expenditure of non-resident anglers in Minnesota in 1956 was $29,060,000.00. About a third of the total expenditure was for food, a third for lodging and a third for other items. About three-fourths of the money spent for lodging was spent at resorts. Preference of non-resident anglers for different parts of Minnesota was judged by compiling home addresses for those purchasing licenses in three representative counties. Illinois residents predominated in St. Louis County of the northeast and Iowa residents in Le Sueur County of southern Minnesota. In Hubbard County in northwestern Minnesota many states were represented with no preponderance of non-residents from any one state. Non-residents, who expressed a preference, preferred walleye as a sportfish with northern pike second, bass third and these followed in order by panfishes (crappies and sunfish), bullheads and trout. Of those who caught fish, 41 percent caught northern pike, 40 percent walleyes, 34 percent panfish, 14 percent bass, 8 percent bullheads and 1 percent caught trout. (Auth. abst.)

3141. Moyle, John B. 1958. REVIEW OF LITERATURE ON PLANT GROWTH AND WATER LEVELS. Minnesota Fish and Game Investigations, Fish Series Number 1, Minnesota Department of Conservation, Division of Game and Fish, Bureau of Research and Planning, pp. 35-45.

The fact is generally established that upland plants require aerated soil for root growth and do not have root systems below the permanent zone of soil saturation or water table. The water table tends to conform to the topography of the land surface but with less variation in contour. The nearness of the water table to the surface is an important factor in the distribution of plant cover types.

All soils are saturated at times but different trees and herbs tolerate in differing degrees the amount,

frequency and duration of soil saturation. Flooding which occurs during the dormant period has little adverse effect on the plants or seeds. Information on the tolerance of a number of Minnesota trees to inundation for various periods is offered along with similar data on a number of herbaceous species. (Auth. abst.)

3142. Scidmore, W. J., and Zane Scheftel. 1958. RELATIVE EFFICIENCY AND SELECTIVITY OF EXPERIMENTAL GILL NETS OF LINEN AND NYLON. Minnesota Fish and Game Investigations, Fish Series Number 1, Minnesota Department of Conservation, Division of Game and Fish, Bureau of Research and Planning, pp. 46-53.

Linen and nylon gill nets of standard experimental type were fished in four Minnesota lakes to obtain information in comparative fishing efficiency. The two types of nets were set either (1) paired end to end in tandem or (2) on the same site on alternate nights. Statistical analysis of the catch of 18 tandem sets made in Lake Winnibigoshish, a large northern walleye lake, indicates no difference in catch means that could not be attributed to chance (at the 95 percent probability level) for northern pike, perch and tullibee. Catch of walleyes was higher in the nylon than in the linen nets (8.1 as compared to 4.2 fish per lift) and this difference is significant at the 95 percent level. Nylon nets in Winnibigoshish also caught more northern pike than linen nets but the chances are only 4 out of 5 that this difference is real.

In Pike and Mountain Lakes, Cook County, sets on the same sites were made on alternate nights with linen and nylon nets. In Mountain Lake where nine sets were made the mean catch of lake trout was about the same in linen (10.1 fish per lift) as in nylon nets (9.8 fish per lift). In Pike Lake (in contrast to the finding in Winnibigoshish more walleyes were taken in the 8 linen (10.0 per set) than in the 8 nylon (6.7 per set) nets. More suckers were taken in nylon than in linen nets in Mountain and Winnibigoshish lakes but in Pike Lake the reverse was true. There appears to be no appreciable difference in sizes of fish taken by the two kinds of nets. (Auth. abst.)

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